The Builder.

VOL. XXXVI. No. 1843. SATURDAY, JUNE 1, 1

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The Outcome of the Water-Supply Congress.

THE Conference on the National Supply of Water, which, in response to the letter of H.R.H. the Prince of Wales to the Council of the Society of Arts, was held at the Rooms of that Society in John-street on the 21st and 22nd ult., presented an innovation in its proceedings which is worthy of all respect. Our readers may remember that on former occasions we have lamented the loss of available power which has usually occurred on occasions of the kind. Not only at the meetings of the Society of Arts, but at those of the Civil Engineers, the British Association, and many other gatherings of a more or less scientific character, the course hitherto adopted has been for the most part simple and uniform. A certain number of papers of very different orders of merit are sent in to the secretary, in anticipation of the meeting. Where the gathering-ground is large, as in the case of the British Association, a certain degree of relation is possible, and some assurance is thus afforded that the contributions actually read will be worthy of attention. The more novel the association, and the more it is dependent for support, so to speak, on previously untapped sources of supply, the greater is the probability against any high level of excellence being maintained by the contributors. However this may be, the papers admitted are read, in alphabetic or other order. When this is done by the secretary, and when that officer, as in the case of the Institution of Mechanical Engineers, happens to be both a rapid and a good reader, the best method is adopted for bringing the matter to the ears of the meeting. When the authors are allowed to read their own papers, the evils of want of distinctness, want of due speed, and the like, generally render the delivery ineffective; or, otherwise, the time of the meeting is consumed by the prolixity with which the reader will linger over his favourite sentences, and intersperse subsidiary remarks. Then follows the discussion. A will very likely contradict *in toto* the conclusions or the premises of the writer. B will attack A, probably rather on the score of something which he has said or written elsewhere, than directly on the matter of his speech. C will take a third stand-point, and perhaps point his quills all round; and when the discussion is brought to a close, each participant will be more confident than before in the strength of his own position, while the general audience will feel slightly bored, and wholly bothered. The printed record of the paper is all that remains, and any light that was struck from collision of different minds is wholly lost.

To avoid this waste of public time, we suggested, in a recent article, the propriety of proceeding by resolution in cases of this kind. This idea was carried into effect at the recent meeting after several papers of interest, written from entirely different, but not inconsistent, standpoints, had been read. Mr. Conder, instead of following the example of the preceding speakers by merely reading his own printed contribution, inquired of the chairman whether the Council would allow of his proposing a resolution to express the sense of the Conference as to the primary necessity of a hydrographic survey of England, the assertion of which idea was the gist of his own paper, which had been remitted to the Society of Arts by H.R.H. the Prince of Wales. Up to that period of the meeting the attention of the Conference had been called to the subjects of the rain-fall of England, by Mr. G. J. Symons, the honorary secretary of the Meteorological Society; to the water in the chalk system, by Mr. Joseph Lucas; to the information to be obtained from the Geological Society, by Mr. Chadwick; and to the importance of gauging the outflow of rivers, by the Rev. J. C. Clutterbuck. Mr. Conder pointed out that, great as was the importance of each of these questions, it was only by such a solution of the problem as would assign to each of them its proper rank, as well as its proper reply, that the object of the Prince of Wales would be attained. In proceeding to discuss such questions as that of the plan proposed by Mr. Hassard for the conveyance to London of the water of the Cumberland and Westmoreland lakes, controversy might be expected to arise. Up to that moment the meeting was undisturbed by any ground of difference; and it might thus be desirable to secure an expression of unanimity in recommending, as a first step, the preparation of a hydrological survey.

After a little consultation among the members of the council, the chairman, Sir H. Cole, admitted the validity of the argument, and promised that, if the reading of the papers were then allow to continue, the Council would prepare a resolution to the effect suggested by Mr. Conder, and submit it to the meeting on the following day.

Mr. J. Bailey Denton then read a paper, which to a great extent coincided with the statements and with the requirements of that of the preceding speaker. He also referred to the machinery available for the raising of water, such as turbines, hydraulic rams, and pumps; and gave some account of the Bill passed last session under the title of the Limited Owners' Reservoirs and Water Supply Further Facilities Act, 1877; and of the Bill now before Parliament to amend the Public Health Act of 1875. Mr. De Rance read a valuable paper as to the geological distribution of the areas of the chief river outfall districts of England. These districts, which had been grouped by Mr. Conder in ten natural provinces, were presented by Mr. De Rance in fourteen groups, under which the geological systems were referred also to fourteen systems. The sums of the several areas, of course, make up the general area of England. Even as to this, however, there seems to be no absolute accord. The round figures adopted by Mr. Conder, from the returns of the Registrar-General, were 58,400 square miles. Mr. De Rance's formations sum up to a total of 57,655 square miles. In a paper read by Mr. Shelford, an analysis of the river basins, as shown upon the Ordnance Survey of England and Wales, made with a view to ascertain whether these catchment basins are generally limited to one or more counties, gives a total area of 57,919 square miles. The fact that a difference of 254 square miles exists between the measurements made of the Ordnance map by two competent engineers, and that the largest of these is less by 432 miles than the total of the eleven divisions of the English and Welsh counties by the Registrar-General, which comes to 58,357 square miles, is alone sufficient to prove the necessity of a general tabulation of our existing information, similar to that which, in relation to the hydrography of Italy, both continental and insular, has been carried out and published by the Italian Government.

Mr. John Evans, F.R.S., travelled over much the same ground as that covered by the two preceding speakers in their papers, although looking at it from general, rather than a detailed, point of view. Dr. Frankland called attention to the fact that the increasing pollution of rivers and streams renders the supply of wholesome water from them more and more difficult. He also referred to the waste of domestic water, as a crying evil, only to be remedied by the compulsory use of meters. In Glasgow, he stated, 38 gallons per head are used for domestic purposes; in London, 26 gallons, and in Malvern, where the meter system is in use, 7½ gallons per head. Ten gallons per head per diem, in the opinion of Dr. Frankland, is amply sufficient for domestic purposes; and would probably never be reached if the water were sold by meter. How much of the difference between 10, and either 26 or 38 gallons is due to the introduction of the water-closet system, no speaker appears to have calculated. Dr. Frankland admitted, in reply to a question by Mr. Conder, that at spring tides the sewage thrown into the Thames at Barking Creek by the Metropolitan Board of Works ascended the river in some degree above London Bridge.

Mr. Hassard brought forward his scheme for the conveyance of 400,000,000 gallons per diem from the lake districts, by aqueduct, for the supply of London. Instead of the vivid debate

which some persons had anticipated would follow the reading of Mr. Hassard's paper, it attracted far less attention from the meeting than any which had preceded it. It is possible that the estimate of an expenditure of twenty-one millions sterling was rather a barrier to the recognition of the practical nature of the scheme.

In our last number we reproduced what may be called the programme of the Conference, being the series of papers submitted to the meeting, and taken as read. The reports in the daily journals are little more than abstracts of this programme, giving next to no information as to the actual course of the discussions. These were marked by admirable temper, very general accord, the introduction of valuable matter, and now and then by an outburst of general fun, which made a very lively time of it. One gentleman, whose admirably good temper predisposed every one to listen with attention, told the meeting that they were all in the dark. He had had the good fortune to make a physical discovery of the greatest importance. People talked about diseases being caused by bad water or by sewage. Nothing of the kind occurred, because it was impossible. The cause of all this mischief was the sun. Sir H. Cole quietly remarked that the object of the meeting was not to discuss the action of the sun, but that of water, to which the speaker rejoined that he would get into the water directly. Unfortunately for those whose curiosity was excited, Sir Henry kept to the programme, and the physical discovery was for the time lost to the world.

The perusal of the several papers is enough to convince any one acquainted with the subject of the value of the innovation introduced into the proceedings of the day. Such papers as those of Professor Prestwich, Mr. Symons, Mr. Homersham, Mr. Bailey Denton, and some others, were each of permanent value, regarded alone. Each, however, has tenfold value if all of them are brought together as part of a systematic whole. To some extent the paper of Sir H. Cole regarded this necessity. The division of England and Wales into districts, each confided to the care of a competent engineer, is one that will be found advocated in the columns of the *Builder* as far back as 1872. Sir Henry Cole, whether led by antiquarian research, or by any mystic view of the power of numbers, recommended what may be called a water heptarchy. Mr. Conder, whose paper came next in order, not only pointed out the natural arrangement of the country into ten districts, but gave a table of the area, rainfall, population, and proportion of water supply to demand, in each; and further delineated the sources of information already at command, and the nature of the observations that would be requisite to complete the hydrographic survey of the country. He also illustrated the case by the experience of the Italian Ministry of Public Works.

In proposing to apply to Government for the appointment of a commission, the resolution went a little beyond any of the papers; or, indeed, put in plain terms what had only been hinted at before. Some such step is indispensable; and in the absence of a minister of public works, no doubt a small permanent commission is the machinery most suited to work in harmony with our existing legislation. In seconding the motion for the resolution, as prepared by the council, Mr. Conder proposed, and obtained, the omission of the word scientific. This little change, which met with full adhesion all round, was made in order to prevent the public from coming to the conclusion that an abstract and theoretic division was proposed. On the contrary, it is as the best mode of making practical use of positive observation that the commission is suggested. A morning paper, in commenting upon the outcome of the Conference as something unsatisfactory, has entirely missed the practical sense of the proposal to tabulate and publish the facts which it is necessary to know. At present, any one concerned in a scheme has to collect all the data for himself, as the country used to be surveyed and re-surveyed for and against every newly-projected line of railway. The Bill passed, or was rejected, and all this labour was lost. The *Times* cited with approval the proposal of one of the speakers to ascertain the facts of certain water-bearing strata; but this is only a part of the general problem; which is, to ascertain how much water falls on the island, and what becomes of it. When this is done, the water supply of any city or town will be a matter of very simple investigation. Till it is done, no new scheme can be introduced without risk of unnecessary cost, or of interfering with some other district. All this is so patent that the only wonder is, that those who have so long urged it on the Government and on the country have as yet received so little attention.

The value of the upshot of the Conference will become more manifest by comparing Mr. Bateman's paper with those of Sir H. Cole and of Mr. Conder. The President of the Institution of Civil Engineers throws cold water on the Prince's letter. "How, for instance," Mr. Bateman says, "could any scheme be combined for meeting at the same time the wants of a village in Northumberland and one in Cornwall?" The answer is, in the words of His Royal Highness, by preparing a "large and comprehensive scheme of a national character." That is to say, by ascertaining, in the first instance, the hydrographic condition of the country. His Royal Highness has looked at the map of the island, and has seen that a general knowledge of its water conditions was indispensable. It is just the fact, stated by Mr. Bateman, that "the large cities and towns provide for themselves and their neighbours, but many small isolated villages lie beyond the reach of such places, or of the aqueducts which supply them" which forms the state of things which it was the intent of His Royal Highness to remove, and which will be removed owing to the Prince's initiative. As to aqueducts to supply them, that is begging the question. Sir Henry Cole said "the capital required might be a hundred millions or more." The idea of enormous outlay, long aqueducts, and the like, is one which a thorough investigation of existing sources is likely largely to modify. Enough water comes home to us all, and when we have ascertained all the facts of the case we shall be in a position to avail ourselves of the bounty of nature without spending millions on aqueducts. The matter is now placed in a good groove, and we shall have reason to congratulate the country if the measure which we have so long advocated as of primary necessity is now seriously taken in hand.

CHINA AND JAPAN AT THE PARIS EXHIBITION.

IN spite of their variety there is always a sense of monotony stamped upon all exhibitions of purely Asiatic art and industry. At the same time, however, there is a strong impress of character upon every detail, which goes far to redeem this unvarying Orientalism. And it is this which confers so unique an interest upon the Chinese and Japanese cabinets, as they may be termed, which have now been opened to the world at Paris. If regarded only as curious collections, they may, perhaps, be passed over as little more than additions, on a large scale, to the familiar *bric-à-brac* of Eastern connoisseurs, but if, examined minutely, they point to an essential difference between Chinese and Japanese arts, manners, and ideas, they acquire an interest which is historical. The distinction, in order to be recognised, must be very closely traced indeed. There has not been a very large space permitted for their exhibition; but the narrower the limits the better is the opportunity for a close appreciation of the contents. But the first salient point in both these collections is the refusal, on the part of both Japan and China, to put themselves in avowed competition with Europe, — with London, Paris, Berlin, or St. Petersburg. This, while it takes them beyond the range of cosmopolitan rivalry, gives a keener zest to the emulation between themselves. Yet, while asserting their traditional independence of foreign ideas, both nations volunteer for the race, and it may be a matter of doubt whether Chinese and Japanese steam-engines, and Japanese and Chinese photographs, are better represented at Paris than the stock jars, fans, screens, and other frivolous miscellanies of Oriental luxury. In another respect, too, they both egregiously fail. They exhibit great masses of furniture as examples of their progress in the modern arts, in moulding, carving, colouring, and so forth; but nine-tenths of these bear the hall-mark of Europe, — that is, of Hong-Kong, Canton, or Shanghai,—which is to be regretted, because wherever the native capacity, pure and simple, sports itself, the result is interesting, as, for example, in a little wall of white Chinese brick, reputed to be more durable than any manufactured in Europe; and in a group of "piles" prepared for bridge and foundation building by a process unknown, as yet, in the West. It can hardly be the object of an International Exhibition to preserve such secrets, yet, if there be blame in the matter, it has been shared equally between the East and West; and all industries, it must be remembered, were "mysteries" at one time or another. There are to be noticed, too, in this class, the fantastic groups of animal figures in porcelain, intended for the decoration of tombs or dwellings as the occasion may require, and the same material wrought into the shapes of tables, chairs, side-boards, stoves,—a hint to Germany,—and even mingled, in numberless constructions, with ebony and bambû wood. In the art of furnishing, these Orientals possess a kind of magic. Except when copying the West, and employing its artisans, they rely exclusively upon their own light materials, and their own speedy workmen. It is one valuable result of these displays that they enable Europe to distinguish between the rapid and still apparently elaborate work of such countries as China and Japan, with their pretentious minutiæ of detail, and the devotee art, as it may almost be termed, which dedicates the labours of ten men, during ten years, to the weaving and embroidery of a single shawl.

We meet, of course, at the Paris Exhibition, with specimens of Chinese porcelain attributed to every known or traditional age in the chronicles of that famous manufacture. However, with regard to the examples assigned to a period nearly 3,000 years anterior to the Christian epoch, they may be at once set down among the fables of the curiosity-mongers. The reputed, or traditional, inventor of the art, the Emperor Houang-ti,—supposing him to have ever existed, —was not born, according to Chinese chronology, until three centuries later, which rather throws some of the Chinese Court at Paris into the shade. But, unfortunately, allowing all the antiquity credible to this manufacture, it seems impossible to distinguish, even here, between the results of forgery and those of original production. Not a few of the "modern" Chinamen, in fact, challenge a comparison between their avowedly new "painted" and "embroidered" work, and that for which no authenticated date can be claimed. There is no matter for regret in all this, because, if true, it would simply prove that the story of a lost art is a fiction, and that sometimes nations may not be so dead as they seem; and a similar remark applies to the exquisite fans, of painted silk or rice-paper,—the latter scarcely less durable than the former; the delicate sculptures in jade and ivory; and to the designs,—though these are visible in photograph only,—which relieve the sculpture of the East from the charge of being invariably inhuman and grotesque. We have marble, though not of Carrara, shaped by true artistic hands, without, be it remembered, the previous and guiding assistance of clay modelling; and the fragment of a balustrade in this material, from the Palace of Pekin, is an architectural study in itself, together with pieces of roof, wall, and terraces from the same edifice. The lacquer work is, of course, characteristic, and may be revisited; and the bronzes, from the continent, as well as from the islands, though moulded by a different genius, are, from the point of view of historical ideals, equally magnificent. It was a mistake, however, to classify with these either Chinese or Japanese glass-work. Neither nation can claim glass-making as an industry of its own. It was an art introduced into the far East by those great pioneers of civilisation, the Jesuit missionaries, and has never enjoyed any high development, for even to this day the Chinese employ mica or paper for the glazing, so to speak, of their casements. Their curtains of silk, it must be said, judging from the illustrations at Paris, are incomparably superior to their windows. With the Japanese, we find, so far as their display at Paris is concerned, a somewhat higher ambition to excel in the sight of the Western world. They bring arms, tools, articles of luxury, children's toys, pictures, and useful plants and minerals; but as is invariably the case, no sufficiently distinct line is drawn between their "exhibits,"—to employ an odious neologism,—and those of China. With respect to themselves, however, it is important to observe that they disclaim the idea of being a solitary, isolated, homogeneous people, representing one industry, one art, one stage of civilisation alone, for, on the contrary, they illustrate, on the part of their particular islands, and even of their especial provinces alone, a

peculiar type and epoch of art. Thus a period is marked, before the arrival of European trade, which, as is well known, was inaugurated by the Dutch. We see this also illustrated at the Paris Exhibition, by the varying claims of Yedo, Hakodadi, Nagasaki, Osaki, and so forth, opposed by the hereditary assertions of Satsuma, Nagato, and Fijen,—all three of them representing, however, provincial and family interests rather than local and hereditary talent. We have here, nevertheless, the key to the genius of the Chinese and Japanese cabinets in the Paris Exhibition of 1878. From Japan there is the model of an artisan's or small shop-keeper's house,—an oblong building surmounted by a slowly-sloping conical roof, thick and heavy, partly thatched and partly tiled. There are no steps mounting towards the interior; the windows, as we have said, are composed of materials even more artificial than glass, and sheets of polished steel supply the place of mirrors. To this point has Japanese luxury attained, with thickly-woven fabrics, as defences from the cold; heavy garments of fur; and, above all, furniture, of singular fabric, for a people who use neither tables nor chairs. It is difficult for a European eye to understand, indeed, how Japan can be made so domestically comfortable with so little furniture, an immense *armoire*, sometimes actually let into the wall,—not a table, not a chair, a gigantic set of "tea-things" in porcelain and crystal, and a clock hung up between two masts of gold. But, carrying the sight a little beyond these superficial prettinesses of the Exhibition, we find the perfect model of a Japanese home, rich in enjoyable ornament, yet almost destitute, perhaps, of that which, in Europe, would be called furniture, since the people, with a fortune around them, in the form of vases and lacquers, sleep on bare boards, and have nothing in the way of domestic furniture to exhibit, as a pattern from Asia, to the imitative spirit of Europe. Japan, at the Paris Exhibition, modestly pleads that it has little to show beyond its mechanical ingenuity, and its long-tried experiments in the fine arts. European critics are wrong in saying that in this respect they have nothing to learn from Japan. The Japanese know nothing of perspective; theirs is essentially a surface and a decorative art; but they still possess some secrets, the teaching of which to Europe might be well worth a little even of Western study. The Exhibition contains a large collection of those varieties so characteristic of Chinese manners, and important to them, illustrating the processes and utensils employed in the adaptation of tea as a commodity for human enjoyment. From every point of view, however, we have found these Eastern departments interesting, and, in many respects, instructive.

THE REPORT ON THE HEALTH ACT AMENDMENT BILL.

A SELECT Committee, consisting of fifteen members, was nominated by the House of Commons, on the 19th of February last, to consider a proposed series of amendments to the Public Health Act of 1875. Not only is the report of the Committee deserving of attention, but, as is so often the case, the minutes of evidence contain much valuable information; and papers are printed in the appendix which deserve a wider publicity than is that usually attained by a Blue Book.

The *ratio entis* of the Committee was the usual fountain of dispute, litigation, confusion, and cost,—namely, the inability of a body of 656 men to draw up a form of words that shall hold water, when it comes to the detail of carrying out a general resolution. "From the date of passing the Public Health Act up to last session of Parliament it was believed that provisional orders could be obtained under the Act, by which water rights could be compulsorily taken." Such, no doubt, was the intention of the Act, or at least, of its framers and supporters. Such were the opinions of the Local Government Board, which issued several provisional orders for the compulsory taking of water rights. Suddenly and awkwardly, during last session, a committee of the House of Lords, while considering a provisional order obtained by the Local Board of the West Houghton District for the compulsory purchase of a water right, came to the conclusion that the order was *ultra vires;* "and consequently it was not confirmed." The Law officers of the Crown were then consulted, and came to the satisfactory conclusion that they were of opinion that "the Local Government Board cannot confer upon a local authority power to purchase, otherwise than by agreement, any right to abstract water from any stream."

It follows, in the opinion of the Committee, that, before water from a stream can be taken by any sanitary authority for the water supply of its district, an agreement would have to be made with every owner, lessee, and occupier, below the proposed intake, who may be affected by the abstraction of the water. It is proverbial to speak of the incertitude of the law. The expression, however, is not very appropriate. The law, as far as it is undisturbed by jejune statutes, is certain, stable, and comprehensive. It is the tinkering of amateur legislation that is uncertain. The local authorities, who up to this time have been successful in raising and spending a large amount of money, whatever they have to show for it, are now discovered, by the slow perception of a Committee of the House of Lords, to have been clothed with an imaginary authority as to one essential requisite of any useful action. The Local Government Board has been giving an equally imaginary sanction to the exercise of this imaginary authority. Local and central authorities have been alike in the wrong as to the very A B C of these operations. Can there be a more pregnant comment on the opinions we have ventured to express as to the care, forethought, and wisdom displayed by the framers of the Public Health Act?

A sanitary authority, we are told by way of consolation, can still obtain compulsory powers by a private Bill. So, no doubt, can a canal company, or a waterworks company, or a private individual, if they get their Act. But it has been pointed out, the report adds, with a certain amount of grim humour, that the cost of obtaining a private Bill is much higher than that of obtaining a provisional order. The method contemplated for empowering the local authorities has not only broken down, but so completely broken down, according to the inference of the committee, as to be incapable of being set to rights in any way except by the usual panacea,—new legislation. Even proceeding by agreement is not competent to the unlucky local authorities. For if ninety-nine parties interested in a water-course be liberally dealt with and fully content, the hundredth,—discovered, may be, after costly works have been carried out,—may upset the whole affair, or demand his own price for his consent.

There can be no doubt that a blunder of this nature is excessively discreditable, wherever the blame may fall. As to that we have no opinion, nor do we care to form one. The actual hitch seems to be that the power was given by the Act of Parliament to the local authorities for the compulsory taking of "lands." "Lands" are defined to include "messuages, buildings, lands, easements, and hereditaments of any tenure." How it is that water rights do not come in under the term "hereditaments" we do not profess to understand. There can be no doubt that a matter of such prime importance to the very commencement of the operations of a sanitary board ought to have been clearly and distinctly stated. The omission to make such a statement was a blot on the Act of Parliament, and a piece of slovenry in all responsible for it. Still, with the utmost respect for the House of Lords' Committee, we cannot understand on what ground they have so sharply limited the word hereditaments in the teeth of the obvious aim and intent of the Act of Parliament.

Another hitch has been discovered, hostile to the peace of the ill-devised and ill-advised local authorities under the Public Health Act. "The Committee have had pointed out to them very forcibly that the prevailing practice with regard to defraying the costs of a water-supply does not appear to meet the equity of the case." It is not urged as yet that everything that has been done by every Sanitary Authority is illegal, owing to the above-declared illegality of the acquisition of water. Perhaps we may look forward to a crop of lawsuits on this ground a little later. But when the water is obtained, it seems that iniquity presides over the charges made for it. At present a Sanitary Authority may recover the cost of the water-supply (that is we suppose, when the other difficulties are cleared up) in either of the following ways:—1. They may charge the whole cost upon the rates; in which case it is paid out of the rate for special expenses; or, 2. They may defray the cost by water-rates or water-rents upon the consumers of the water. These charges may be insufficient, sufficient, or more than sufficient, to meet the costs of water-works. If they are insufficient, the rates have to make up the deficiency. If they are more than sufficient, the rates will be lightened by the surplus revenue derived from the water-works. It appears to the Committee that grave evils result from this state of things. It frequently happens, they remark, notably in rural districts, that the whole charge is borne by the parish, under the rate for special expenses, while the supply of water is limited to the village, or to a particular part of the parish. Those who live out of this favoured locality have thus to pay for the convenience of the residents in the part supplied with water,—a fact that in many cases has raised a formidable, and even an insurmountable, objection to schemes for water-supply.

Again, it occurs in other cases that the Sanitary Authorities charge water-rates and water-rents on too low a scale. In this case the cost of the water to the actual consumer is lightened at the expense of the ratepayers in general. Nor does this exhaust the list of troubles that loom on the vision of the Committee. The price charged for water by some authorities is, it seems, too high. In this case "another grievance arises, viz., that the rates are lightened at the cost of the consumer of water. If a large ratepayer were not a large consumer of water, it would be his interest to have the total amount to be raised by rates lightened by the surplus profit derived from the water-works."

In considering the difficulties thus naturally arising from the intrusting to totally uninstructed bodies of men the decision of questions of a simple business character, the committee seem conscientiously to have regarded themselves as placed in a like position. Painfully and hesitatingly, however, they have made some way through their difficulty, or rather, have been wise enough to catch at the good advice given them by a gentleman who is not an amateur legislator. "After full consideration of these cases," the committee have luminously arrived at the opinion that they "think that the sound principle to lay down is that water supplied by a sanitary authority should be paid for by the consumer." The mountain has thus brought forth a mouse; but it is a very well proportioned mouse. "As it appears that this principle, if carried out to its full length, might, in some cases, cause the charge for water to be very high, it seems desirable that a maximum of charge on the consumer of water should be established. On the other hand, it has been shown to the Committee that it is desirable to establish a minimum."

The upshot of this struggle is the recommendation of a suggestion made by Colonel Cox, R.E., an inspector of the Local Government Board. This is to the effect that both a maximum and minimum charge should be prescribed by Act of Parliament, the former being 2*s.* in the pound on the rateable value of any house, and the latter 6d. in the pound on the same rateable value. The maximum that can thus be charged on a cottage of 4*l.* per annum rent is 8*s.* 8d. per annum, or less than 2d. per week, and the minimum is less than ½d. per week. But this plan does not seem to meet the case which the committee proposed, that of "a manufacture being established in which large quantities of water were used." The fact is, that the provision of a certain quantity of water, proportioned to the domestic wants of the population, is all that can be expected under any such maximum and minimum rate; and that the provision of any extraordinary quantities should be made matter of special arrangement, the water being then paid for at something like cost price, and in proportion to quantity actually supplied.

A third hitch has been detected in Section 52 of the Act of 1875. The effect of this section is "to restrict a local authority from providing a water supply when within the limits of supply of a water company." A water company often has a district assigned to it, which includes outlying places to which its mains are not in the first instance laid, but to which it is contemplated that at some future time they may be extended. It is justly observed that such a power should be confined to some reasonable limit of time—or, at all events, that it should not be so conferred as to give to the water company invested with it the means of playing the part of the dog in the manger. As the law now stands, if the inhabitants of a district within

the limit of supply of any water company, or other authority which has been appointed to supply water, will guarantee 10 per cent. for three years on the cost, the company or authority in question is bound to lay down mains and supply them with water. But the usual incertitude here comes in. It is in doubt whether a local sanitary authority can be regarded as "inhabitants," and whether it can legally do—as a constituted body—what any non-constituted body of residents are entitled to do, by giving a guarantee, and charging it on the rates. The words of the Act are, "that a local authority may contract with any one for the supply of water." As it seems, however, that this clause omits the qualification, any one duly authorised to contract with them (as in the case of the owner of partial water rights), the Committee are of opinion that "if there is any doubt about the matter it ought to be removed." It is further suggested that in lieu of a guarantee of 10 per cent. for three years, it would be better to give a guarantee of 7 per cent. until the water rents or rates from the district served amount to a sum sufficient to pay that rate of interest on the outlay. In fact, the doubts that arise are so numerous, and the language of the report is so confused on the subject, that we must pass on to the outcome of the discussion, which is to the satisfactory effect that the Committee recommend the propositions brought before them to the attention of Parliament. It is probable that no opposition will be raised to such a recommendation. Still, looking at the total want of definite aim which it veils, one is tempted to ask of what use was the appointment of a committee that refers the whole subject back again to the body which appointed it?

Hitch No. 4 is "the fact that a rural sanitary authority has not the power to oppose by counsel a Bill in Parliament, by which it is proposed to take water from their district, though they can petition against it." Here is another instance of the slovenly manner in which the new authorities were constituted by the original Act, but we cannot enter into it.

The Select Committee cannot, at all events, be fairly charged with any great rashness of over-statement. That the laying before Parliament of "any information which," in the quaint English of the Report, "it is important for Parliament to know" might help to solve the problem of water supply is, at all events, highly probable. But the really interesting part of the case is that the Committee make a recommendation which involves, however unconsciously, a primary principle for which the *Builder* has contended since the first debate arose as to the form and scope of the Public Health Bill of 1872. The Local Government Board, if required to supply to Parliament a report as to the probable wants of any districts to be affected by legislation, must be enabled to do so, not as a matter of hand-to-mouth inquiry in each individual case, but as part of a general systematic knowledge of the water requirements of the country. Nor will this, taken alone, be of the slightest utility. Not only the requirements, but the means of supply, must be known. The Committee see, and see truly, that the wants of one district are not to be regarded without reference to the wants of their neighbours, if there be any question as to source of supply. But they do not appear to have imagined that there is any established relation between demand and supply. They speak of investigating the first without reference to the second. This has been the radical error of every great scheme of water supply of late brought before the public. A wants so much; and proposes to take it from the ground of X, passing through those of B, C, and D by the way. Before we answer A's demand, say the Committee, let us ascertain how much B, C, D, and X are also likely to require. So far, so good. But this is only half the question. What is the natural source of A's supply? Is X's the nearest available? And so on for B, for C, and for D. Unless this question be solved, it is idle to put the former one. This the Committee do not appear to have comprehended. But it is an inseparable condition of any intelligent inquiry into the case.

But what does this involve? What must the Local Government Board do, in order to put themselves in a position to report to Parliament, or to take any measures of their own authority and initiative, as to any matter affecting the water supply,—or the water discharge,—of the country? They must begin at what we have always insisted on as the beginning. They must provide themselves with a proper hydrological survey of the country. If the Report of the Select Committee on the Amendment of the Public Health Act has any consequent meaning, the necessity of such a survey is the first requisite.

The final clause of the summary of recommendations, with which the report concludes, is such as to leave no room for doubt on this score. We quote the words, "That, when a company or corporation goes to a rural district for water, Parliament, before giving the powers sought for, should be informed of the wants of the district from which water is proposed to be taken, or through which the main passes, in order to make provision for these districts." Lest any reader should think that we have been too severe, or too light, in the criticisms we have let fall on the workmanship of the Report before us, we must call attention to the fact that the above clause of "summary" does not, in point of fact, by any means represent what we were told just before, in clause 17, that "the committee therefore recommend." Nor are the discrepancies unimportant. The earlier clauses dealt with the question of the wants of "sanitary authorities." The summary speaks only of "company or corporation." The earlier clauses propose that a report should be made to Parliament by the Local Government Board. The summary is to the effect that "Parliament should be informed," which it always is. The case of the promoters of every such measure is always based on the information which, in support of such case, they submit to Parliament. The case of the opposition, where there is one, is based on information collected with a different animus. The decision of a Parliamentary Committee, between these two conflicting bodies of information, probably mainly depends on the ability of the engineer or other chief witness to stand examination or cross-examination, and to gain the confidence of the tribunal. It is, at the present moment, far more a matter of personal ability than of fact. To suggest the intervention of the administration may or may not be wise and good. It is, at all events, a total change of procedure. But that with which we are concerned is, what it involves. It is proposed that Parliament should lay on the shoulders of the Local Government Board that very responsibility which the latter has always declined, but in the absence of which no justification can be adduced for the existence of such a department of the administration.

In a word, the Report of the Committee assumes that the Local Government Board ought to be in a position to advise Parliament as to the propriety of passing or rejecting any application for powers affecting the water supply of the country. For such advice to be anything but futile, if not actually mischievous, the Local Government Board must show what the actual conditions regulating the water supply of the county, district by district, are. It is very true that the Committee only speak of the wants of the districts. But that is only a crucial example of what the whole Report breathes,—the practical unacquaintance of the members of the Committee with the matter brought before them for decision. The patient attention to all that was urged seems deserving of all praise. But they evidently were not a body of engineers, nor was the subject brought before them as it would have been done by a great engineer. They are convinced, however, that the central authority must have a voice in the matter. There can be no doubt of this necessity, unless we are to be like the monkeys in the Zoological Gardens, each district stretching out a thievish hand for its neighbour's supply, while neglecting its own. For the opinion of the central authority to have the slightest weight, it must be based on knowledge. That knowledge is only to be rendered permanently useful and available in the form of a proper survey. To this, then, according to any mode of regarding the case, we must come. The sooner this fact is acknowledged and acted on, the better for the ratepayers, for the sanitary bodies, and for the people of England. Mr. Brown's Bill for the Amendment of the Public Health Act is a meritorious attempt to facilitate the supply of water to the rural districts, but in logical order requires to be preceded by the completion of the hydrographical survey of the country.

The New Dublin City Markets.—The Dublin City Markets will be erected from designs by Messrs. Lockwood & Mawson, of Bradford. The estimated cost is 70,000*l*.

THE ARCHITECTURAL CONFERENCE.

THE general conference of architects, which will open at the Institute Rooms on Monday next, will, we hope, be well supported by the members of the profession not resident in London, whose attention we call especially to this opportunity for meeting on common ground, and discussing subjects of common interest to the profession. That the town members will attend in force we have very little doubt, if only because we are sure there are many who will feel with us, that the able, painstaking, and business-like manner in which the president, Mr. C. Barry, has devoted himself to the duties of his office, calls for every recognition and support from his colleagues. But to the country members (and to country architects who are not members, but who ought to be) we especially suggest not to let slip an opportunity of assisting to consolidate the *esprit de corps* of the architectural profession in England, in which more unity of feeling and of action is so much to be desired. And there is the more reason that they should come forward heartily, inasmuch as it is quite certain that nothing has been neglected in the arrangement of the programme to make it, as far as possible, of special interest to visitors, and to provide for their convenience and their welcome in every way. Indeed, it may be said that they have been more thought of than the resident members; there is the greatest desire at head-quarters to secure their co-operation, and to give them every facility for seeing and for saying what they wish to see and to say; and we believe the Conference will be regarded by the Council as a success very much in proportion as it results in drawing together the leading representatives of the profession scattered throughout the kingdom. That, at all events, is our opinion; for we consider one of the most-to-be-desired ends in connexion with the architectural profession is that the central representative society should become more truly and actually representative of the whole British architectural profession, both in view of the internal working of the profession and of its relations to the public. Nearly everything which it can be reasonably said that the Institute of Architects might do and does not do it is prevented from doing simply by the fact of men holding aloof from it, from no intelligible motive: men who complain that it should do this and that, without reflecting that their own help might be a step towards accomplishing more; at all events, that their absence from the ranks creates an appearance of weakness and want of union which has a very bad effect on the status of the profession with the outside public and the press. We should like to give a sample from our own knowledge of how this condition of things acts in regard to public opinion. An architect, who was a member of the Institute, was attacked in conversation by a clever literary man in regard to the supposed sins of architects in taking builders' commissions and in making their own profits out of works independently of their client's interests, about which we heard a good deal of nonsense recently. Of course, our professional friend naturally said, not only that no architect occupying even a respectable professional position would think of soiling his hands in that way, but that the rules of the Institute of Architects compelled every one becoming a member to bind himself against taking remuneration directly or indirectly from any tradesman, and that any member against whom such an allegation could be proved would be liable to be struck off the Institute list. "Very likely," was the answer, "but would that disqualify him in any degree in public estimation?" Of course, the admission had to be made that it would not *necessarily* do so, because it is known that some architects whose abilities and character are beyond question are not members. Now, it is *these* gentlemen who are actually, in such a case, tying the hands of the representative society of architects from doing their work in ensuring purity of practice and public respect for the profession. If every one who has these objects in view would consider it his duty to belong to the Institute of Architects, it would be a comparatively easy matter to quash irregular practices in inferior quarters, and to establish the profession in a position in public opinion which would render the libels which some newspaper correspondents and others have thought fit to circulate against it simply absurd. But where there is so much of disunion and party spirit within the profession, it is no wonder if people

who are not familiarly acquainted with its workings know not what to think when they hear such charges made. We cannot help thinking this consideration very *apropos* to the occasion when another re-union of the architects is invited, and we hope those to whom it applies will give a thought to it; merely adding that in again urging this topic, we are not by any means speaking from an Institute point of view or in the special interests of the present governing body, but in the interests of the profession at large, some of whom we consider are making a great mistake, and neglecting an important means of strengthening their position with the public, by not giving their adherence to the only body which has the position and the official machinery* for acting adequately as a representative influence.

Coming from this general topic to the more immediate object of the Conference, we may say that the programme seems to us to be very well adapted to combine the useful with the agreeable, and that in the main every one who runs an eye through the list of subjects must be struck by its eminently practical character. The first paper, by Mr. Armitage, on "Mural Painting," is in one sense a purely artistic subject, and one which has excited much interest on artistic grounds of late, but that also is a good deal allied with practical questions as to the best materials for standing in this climate, &c. The other three principal subjects, "The Corrosion of Iron," "The Model Bye-laws as the Basis of a Building Act," and "Concrete and Fire-resisting Constructions," are all of the most rigidly practical character, and all deal with subjects of immediate interest in regard to the work to be done in the buildings of the future; and it will be strange if some really valuable information and suggestions are not elicited in the course of the meetings devoted to these subjects. Two other equally practical subjects are to be illustrated in the course of the meetings, one by Mr. I'Anson, who will contribute a paper on the "Iron Ribs to carry the Roofs of the new Corn Exchange," and by Mr. Penrose, who will explain to those who visit St. Paul's Cathedral the means adopted to protect the dome from fire. The visit to Mr. Waterhouse's great building at South Kensington will also have its practical side, for it furnishes the most extensive and we believe the most successful instance in this country of the architectural use of terra-cotta, and there will no doubt be a good deal of information to be gained on the practical side of that subject. Archæology is not forgotten, and the last meeting of the Session is devoted to two archæological papers by Mr. Roger Smith and Dr. Phené. But we specially congratulate the Council and those who will attend the Conference on the very practical nature of the programme which has been made out, not because we by any means think more lightly of the artistic side of architecture than others, but because we consider that it is in regard to practical subjects that discussion and interchange of information are so specially valuable. The art part of architecture is so much a matter of personal taste and predilection, and admits of so many different views and feelings, all with more or less to recommend them to various persons according to their education and temperament, that it is hardly a matter on which fixed conclusions can be arrived at by discussion, though it is interesting to exchange feelings and opinions. But the practical side of architecture hardly admits of difference of opinion except that which arises from difference or insufficiency of knowledge; there is always the best material for a given purpose, the best way of using that material, the best form of construction in a given case, capable almost of mathematical demonstration if we only get facts enough; and the advantage of meeting and discussion is to put together, on such subjects, as many facts and as many experiences as possible, and eliminate the results for future guidance. In regard to this view of the subject we should not have omitted to allude to the proposed visit to Mr. Kirkaldy's testing works, when some of the most efficient and direct methods of arriving at facts in regard to materials will be practically illustrated.

Those visitors who want relief from these more serious studies will find a good deal to interest them in London just now, in the way of art at all events; and some of the finest private collections have been kindly thrown open for the inspection of all members of the Conference. We hope all who attend will have both a pleasant and a profitable week.

EDINBURGH.

HERE, as elsewhere, the general depression in trade is felt, and although the price of material has fallen, and wages are down, there is a great falling off in building speculation. The demand of late seems to have set in for commodious flats rather than for self-contained houses or villas, and to meet this demand, sites which would otherwise have been reserved for separate villa residences have been usurped by large tenements. The temptation to erect such is great; for, not only does the builder secure a larger profit by selling each flat separately than by disposing of an entire building, but the proprietor of the ground exacts a separate feu (ground-rent) on each, which in the aggregate is more than what he would obtain from one vassal who requires a self-contained house. This turn of the tide has had a detrimental effect upon some parts of the suburbs, destroying their semi-rural appearance, and interrupting the view, and is particularly unsatisfactory when no attempt has been made to give the blocks of buildings a skyline.

The only new buildings of any magnitude commenced this year are the Medical Class-rooms. Both the infirmary and the cathedral are approaching completion, but the great tower and spire of the latter will necessarily be a work requiring time and caution in its erection. From some points of view, the tower, although the first stage is not complete, dominates over the surrounding buildings, and in coming down the Mound we remark that it takes up a position further to the south than we expected.

The present state of uncertainty as to peace or war has led to a vigorous effort being made to enforce upon Government the necessity of proceeding with the project for fortifying the Firth of Forth, which has been in abeyance for a long period. Colonel Moggridge, commanding Royal Engineers in Scotland, has prepared plans for the erection of batteries, which have received the approval of the War Office, and the erection of them is to be prosecuted forthwith. These are to occupy sites on the island of Inchkeath, and on a point to the west of the village of Kinghorn, on the Fife coast.

The statue to Dr. Chalmers, the execution of which was entrusted to Sir John Steele several years ago, has now assumed shape. It is of bronze, of heroic proportion, and will occupy a site in the centre of George-street, at its intersection with Castle-street, and it will complete the series of public monuments which adorn the centre of the former broad thoroughfare.

The good Dean Ramsay took the leading part in promoting the Chalmers memorial, and now the dean is to have two monuments to his memory, one public, and the other in St. John's Church, in which he officiated. The public monument is to occupy a site on the ground attached to St. John's in the line of Princes-street, and facing South Charlotte-street. It is to consist of a runic cross of red granite, 24 ft. in height, designed by Mr. R. Anderson, A.R.S.A., and, in addition to characteristic ornamentation, is to have a bronze medallion of the dean. The memorial in the church takes the form of a mural tablet in bronze by Skidmore. The tablet is surmounted by a silvered and gilt canopy which is supported by shafts bound with traceried fillets. The canopy is decorated with enamelled plaques representing the rose and thistle, and with clusters of amethysts and crystals. The crest is of silvered foliage and enamelled daisies, and the apex is crowned by a cross enriched by amethysts and crystals. The inscription is on a tablet at the base having a border of forget-me-nots, onyx stones, and pebbles.

The final step toward the realisation of the scheme of the late Mr. David Bryce for the improvement of the Bank of Scotland, has been carried out by the removal of the screen-wall to the north of the building and the substitution of a terrace backed by brick-vaulting. The ground above the vaulting is levelled, and has received a coating of asphalte to prevent the penetration of moisture. The elevation of the terrace is broken up by rusticated piers, above which are pedestals, with balusters between; the terrace wall is returned at either end to meet the sloping ground upon which the bank stands, and at either angle is an open pavilion consisting of four arches with a flat roof surrounded by balusters. The work has been carried out under the direction of Messrs. Peddie & Kinnear.

THE HEALTH AND SEWAGE OF TOWNS.

CONFERENCE AT THE SOCIETY OF ARTS.

THE third annual Conference, under the auspices of the Society of Arts, on the health and sewage of towns, was held on Thursday and Friday in last week, the Right Hon. James Stansfeld, M.P., in the chair. There was a large attendance of professional men and others interested. The programme included papers and discussions on (1) the gradual abolition of cesspools and middens, and substitution of tubs and pails, with speedy removal; (2) the progress, if any, made in treating water-carried sewage since the last Congress; (3) escape of sewage gas into dwellings, and modes of prevention; (4) progress, if any, made in the utilisation of excreta since the last Conference; (5) discharge of sewage into the sea; (6) cost of systems given in the last Report of the Local Government Board; and (7) whether any further legislation, of a compulsory or permissive character, is needed for bringing about a better sanitary condition of towns or dwellings, or any change in imperial administration.

The Chairman, in opening the proceedings, remarked upon the work which the conference had undertaken, and said that they had seen enough of such conferences to be satisfied of their utility. He thought the time had come when they might advisedly enlarge their scope of inquiry. The subject they had undertaken to investigate was at first a somewhat narrow one, and they widened it to the larger question of the health as affected by local government arrangements, which was a part, and possibly not the largest part, of a very much larger question of the national health, viewed in all the causes of national disease, and the influence which the effect of the health had one way and another. Cleanliness was a great source of health, and in the promotion of cleanliness local government could do a great deal with the view of providing clean air to breathe, clean water to drink, clean persons, clean habits, clean houses, and so forth. Upon those matters the previous conferences had arrived at distinct conclusions. They had expressed their view that by legislation as far as necessary, local authorities should have the power and control over the house-drains as well as over the public sewers, so as to be able to fulfil their implied contract with the inhabitants to remove the sewage without allowing the generation and escape of sewer gas. As to the question of pure air, the local bodies could do much, but they could not control that question within the dwelling, and compel internal ventilation. If people preferred their windows shut, and preferred foul air to pure air, it was not for local authorities to place a policeman to every dwelling to see what was desirable should be done. They could not secure that, nor even cleanliness of habit. All those things were matters of education; and he largely viewed the question of health as a matter of education. He looked forward to the day when local government would be further advanced and better understood by the community at large, and when the education of the young would be in the hands of the ordinary local governments of every locality. That he believed to be the future of education and local government, and when that time came he trusted that the science of national health would be taught in the schools of the United Kingdom as much as the "three Rs" were.

Under the first head of the programme, "The gradual Abolition of Cesspools and Middens, and the Substitution of Tubs and Pails, with speedy Removal,"

Alderman Taylor submitted a paper describing what had been done, and was doing, in Rochdale. He stated:—

"The collection of excreta and house-refuse in pails and tubs has been in operation in Rochdale for ten years. The rate of increase in the adoption of the pail and so the

* We cannot help adding that hardly any society of this kind could be better organised in its working than the Institute of Architects now is. With the exception of a recent regulation in regard to the discussions on papers, which we have before said was a mistake (and which will probably be altered), there is really an extent and completeness of organisation for doing everything that is wanted, and considering every subject that requires consideration, which can hardly be improved

gradual abolition of the cesspools and middens, will be seen by the following figures:—

In March 31st,	1870,	there had been adopted	527	pails.
,,	1871,	,, ,,	543	,,
,,	1872,	,, ,,	620	,,
,,	1873,	,, ,,	819	,,
,,	1874,	,, ,,	1,471	,,
,,	1875,	,, ,,	761	,,
,,	1876,	,, ,,	825	,,
,,	1877,	,, ,,	798	,,
,,	1878,	,, ,,	1,140	,,
		Total pails.....	7,504	

The borough was extended by the Act of Parliament in 1872, and now comprises 4,180 acres, being an extension of 3,004 acres. The district added to the borough rapidly adopted the pail system.

The population in 1872 was 45,224, and now, in 1878, is 71,000. On January 25th last it was ascertained that there were still 1,200 old privies and middens, when the Health Committee of the Corporation, being fully convinced of the advantages and economy of the pail system, and the absolute necessity that the practice of 'tipping' should be abolished, decided to recommend that the whole of the remaining old privies should be altered to the pail, and this, notwithstanding the satisfactory increasing voluntary alterations now being carried on.

The town, for the purpose of collection, is divided into six districts, named A, B, C, D, E, and F. Notice has recently been served on eighty owners."

Dr. Wilson, of Rochdale, said that ever since this system had been introduced into the town the death-rate had been continuously lessening. In 1870 it was 27 per 1,000; in 1876, 22; and last year it was 21.

Mr. J. M. Fox, medical officer of health for Mid-Cheshire, submitted a paper, in which he said,—

"It has been the practice of Western teachers of law and religion to concern themselves about things more glorious than the safe arrangement of the excremental process. The word 'typhoid,' in its definition and history, now so well and generally understood, has been the talisman that has awakened statesmen and philanthropists to a knowledge of their error. Preventible diseases are now honoured by being recognised as national adversaries; and it is at last beginning to be considered to be as glorious to save lives at home as it has always been to save them on the field of battle. Yet Moses gave to his people, and through them to the world and to all subsequent time, the leading principles which safely control the discharge of this essential and unavoidable function.* The principles are instantaneous removal, combined with instantaneous disinfection.

I would blend the principles into one still more general and elementary, a violation of which by any one and any where inevitably involves us in peril and in nuisance; a violation of which, therefore, should be defined, and dealt with always as a statutable offence.

The elementary principle I would enunciate is, that excrement once voided should be instantaneously dealt with. To leave it to pollute the common air is a crime against the State and a sin against nature. Such a course indicates a criminal inconsiderateness in the offender, and is an undefinable but not less certain source of injury to others.

In the system of water-carriage, excrement is instantaneously dealt with by means of removal. In the tub or pail or pit, it should be as promptly dealt with by the absorbent ashes, or the more disinfectant dry earth. In the latter system—I mean the dry system—automatic contrivances are not essential. Trouble must be incurred in some part of the process; and dirty and inconsiderate people will foul and spoil the best arrangements. Such persons must undergo a course of correction and education. My assertion, therefore, is this:—that excrement deposited and undealt with is always and everywhere an injurious nuisance, and should be dealt with accordingly."

Dr. Fox went on to speak of the satisfactory working of the ash-closet system in Cockermouth during the last five years.

A report by Dr. S. W. Bushell, physician to the British Legation at Pekin, was next noticed. The writer says:—

"Pekin is fairly well supplied by water. The sewers intersect the city in a rectangular network and open into the canals. The wide parallel streets have a large sewer on either side, into which open the smaller sewers from the lanes. The main sewers are square in section, of diameter sufficient to allow a man to crawl through them, and are constructed of large bricks, and covered with a layer of stone slabs. They are intended, principally, to carry off the flood of rain-water which inundates the city in July and August. This elaborate system, however, is all but useless, having long since fallen into ruin from decay and neglect. Some of the sewers project high above the level of the roadway, gradually worn down by the traffic. All are chronically choked with animal and vegetable *débris*. It is the common practice of the inhabitants to remove one of the flagstones in front of their houses, and to throw in all the refuse, solid and fluid, so that the sewer becomes merely a focus of putrefaction. The putrid contents overflow into the streets after rain, and in dry weather are tapped for the purpose of watering the roads. In short, the sewers in their present condition are not only useless, but absolutely prejudicial to the public health.

The only detail of sanitary work which is at all efficiently performed is the removal of fæcal matters. The fluid excreta are either poured into the roadway or open sewer, or scattered over the street at sunset to lay the dust; but the solid excreta are most carefully collected, as in all other parts of China, for use as manure. They are removed entirely by the dry method. There are no cesspools in the houses, only a shallow hole lined with bricks, which is emptied daily by the scavenger. This is a regular business and means of livelihood in Chinese cities, and the man with a large wooden tub suspended on his back by means of a wide hoop passing over the shoulder, and a long-handled iron scoop in his hand, is a well-known figure in the streets. He does his work as a rule gratuitously, passing from house to house till his tub is full, when he carries it to dispose of the contents at one of the depôts or manufactories. Another man wends his way along the public highway, where he also is able to pick up a fair livelihood, for the common Chinaman never scruples to halt by the wayside, even in broad daylight, and in full view of passers-by. The scavenger often digs holes in the ground of the more retired corners within his circuit for the convenience of the wayfarer and profit of himself.

The matters collected in this way are carried to one of the depôts, whence they are conveyed outside the city in wheelbarrows, with a central-wheel of large diameter, and on each side of the wheel a long coarse wicker-basket, of the estimated capacity of two cwt. The wheelbarrow is driven by one man, who supports it with a yoke over his shoulders, and is assisted by one or more other men dragging with a rope in front. These baskets are quite open at the top, and, being conveyed through the streets at all hours of the day, they are an insufferable nuisance. Within the walls of the city itself, moreover, there are not a few manufactories of manure, and, in fact, any large vacant piece of ground is usually utilised for this purpose. The excreta are first emptied into large holes dug in the ground, then spread over the surface in a layer about an inch thick, and constantly turned over with a spade until they become thoroughly dry. This process takes three or four days, the ground being dry and sandy, and the air remarkably free from moisture during ten months of the year. The manure, when dry, is piled into heaps, and sold retail by the small basket. A ton of this *poudrette* is estimated to sell for about 16s. of our currency, which is the equivalent of a month's wages of a labouring man in this part of China. It is a principle in native husbandry to apply manure to the plant rather than to the soil. The *poudrette* is sown with the seed, or supplied to the root of the growing vegetable before irrigation.

Typhoid fever is a rare disease all over China, although typhus, diphtheria, scarlatina, &c., are rampant in the large cities. The rarity of typhoid may be directly due to the system of the removal of human excreta, preventing the contamination of water."

Dr. Chesshire, of Birmingham, submitted a paper, in which he said:—

"The insanitary evils which have occurred to the health of the population by the introduction of underground or subterranean drainage are incalculable, and call for a prompt and effective remedy; those evils, however, would never have arisen even from underground drainage, had the drains been used for their legitimate and proper purposes,—I mean for the conveyance of liquids only. When an architect designs the plan of a house, by means of traps and gratings he takes the greatest care to prevent any solid matter entering the drains; but when he attempts to deal with the watercloset soil, strange as it may appear, he allows all the fæcal matter, viscid and tenacious as that substance is, all the paper, hair, dishcloths, and other solid matters which are put down waterclosets, to pass through the closet soil-pipe into the same system of drains, in the hope that the rainfall will come to his assistance and remove them. As far as he is able, he takes care, by connecting the roof-water with the drains through the spouts, and the surface-water through the gratings, to remove by water-pressure this filthy mass from the house-drains. But, unfortunately for him, as it always has been and ever will be for sewage utilisers of the modern school, the rainfall is very capricious and irregular: it may not put in an appearance for a fortnight, or even for a month, during which time the collection of fæcal matter in the house-drains is enormous. In this great metropolis I estimate during dry weather in one week that about 1,200 tons of fæcal matter are collected in the house-drains, or about one ounce and a half per head of the population per day. In those drains this collection of filth undergoes putrefaction and decomposition, generating sulphuretted and phosphoretted hydrogen and other foul gases, known as sewer or sewage gases; and it is those gases which so freely and so continually escape into the interior of houses through the various waterclosets, sinks, lavatories, and waste-pipes. . . . . .

So long as the solid portion of the excreta from waterclosets is cast into the drains, unless an arrangement can be made with the heavens to give us a continuous, or, at all events, a constantly repeated rainfall, so that the house-drains may always be effectually flushed, so long will those insanitary evils continue; but if the solid portion of the excreta were intercepted and retained in sealed iron boxes—sanitary interceptors—as I have suggested, the drains and sewers, as well as the rivers into which the sewage flows, would be relieved from pollution to a remarkable extent, the foul gases would no longer be generated, and the solid portion of the excreta would be put into a concentrated and portable form for utilisation, while the urine and other liquids would flow freely and continually away, to be dealt with at the sewer's outfall by subsidence and filtration, and ultimately, when clarified, to be applied to the land by intermittent downward filtration and irrigation, as I have so strongly and so frequently recommended. If we could imagine a section horizontally made under London, such section to pass through the house-drains, and if it were possible to lift up the upper portion of the section, we should witness a most revolting sight, and the residents of this great city would at once be made acquainted with the melancholy fact that they were living over, and almost in the midst of, a vast series or network of cesspools of the vilest description, more vile and more insanitary even than the old middens; bad as those middens were, those nasty receptacles were placed outside the houses, whereas the underground, elongated cesspools of the modern kind are almost in direct communication with the interior of dwelling-houses. It is not in the main-sewers where the insanitary evils exist, for when the solid portion of the excreta of the population gets into those channels, provided that they are sufficiently capacious, and are constructed with a sufficient fall, that material, under the influence of the rainfall, escapes quickly into the rivers, either through the storm outlets or the sewer outfalls, where it pollutes and contaminates the rivers."

Dr. Chesshire concluded by describing the arrangement of the receptacle he had devised. By it the urine is separated from the fæces, and the solid parts allowed to remain and accumulate until the box is full.

"It is so constructed that it may be applied either to a common privy in lieu of an ashpit, or to a water-closet at some point intermediate between the seat and the sewer, catching the excreta of the household and retaining the solid or valuable portion in a portable form, while the liquid passes away into the sewer, and the drains remain perfectly clean."

Under the second head of the programme,—"Progress, if any, made in treating water-carried Sewage since the last Congress,"—

Mr. George Hurst, of Bedford, contributed a paper giving some account of the sewage and irrigation farm at Bedford. He said that,—

"In the town of Bedford a system of water, sewage, and irrigation works has been in operation for the last ten years, which has been attended with satisfactory results. Previously some imperfect drains polluted the River Ouse, and the greater part of the houses had offensive middens and cesspools. The town is in many respects unfavourable for drainage, lying low in the Ouse Valley, and being deficient in declivities. The fall in the lower parts is very limited, but the disadvantages have been successfully surmounted. The plan consists of a main-sewer into which, from all parts of the town, lateral drains are discharged, and at the terminus of the main-sewer it empties itself into a tank 16 ft. deep, so that an artificial fall is obtained, from which it is pumped up, and distributed by pipes over the irrigation farm, which consists of about 180 acres. The pumping and irrigation works are distant a mile from the town.

The town has a population of about 19,000, and from the waterworks receives daily 350,000 gallons of water; the greater part of this, of course, passes from the houses and streets into the sewers, which, in addition, take a considerable quantity of subsoil drainage, making together about 700,000 gallons daily to be pumped up and distributed over the farm. So much of the subsoil drainage passing into the sewer is owing to the main-drains not having been made water-tight, which is certainly a defect, for a subsoil drain and a sewer, when properly constructed, are not convertible, and sewers are intended to convey offensive fluids and excremental matter from our habitations, the ultimate disposal of which, and the rendering it perfectly innocuous, has been considered a question of difficult solution. The subsoil drain is intended to convey from the land the surplus water that it may receive, and may properly be discharged into and supply the regular water-courses.

So large a quantity of water passing into the sewers causes the manure to become excessively diluted, and, as a liquid manure, it does not contribute so much richness to the soil as many suppose, and what fertilising matter it does impart to the sand is soon exhausted by the rapid vegetation. The great value of the irrigation is not so much for the solid matter held in solution, as maintaining a constant and sufficient supply of moisture in the arid seasons. So far from land irrigated with sewage becoming surcharged with manure, to keep it in good condition it will bear a considerable quantity of solid in addition.

The land, being near the town, is heavily rented. Excepting in very rare instances can any unpleasant smell be observed on going over the farm, as the sewage, passing immediately into the ground at once, becomes deodorised.

The sum expended in engineering works, buildings, pumping apparatus, and embankment, was 25,000*l.*, which was borrowed, to be repaid with interest by half-yearly instalments running over thirty-five years. It would be unreasonable to expect any portion of this sum to be obtained from the profits of the cultivation, as, although directly paid out of the rates, the public is fully remunerated for the outlay by the important benefits conferred. Previously to the establishment of the sewage works, each housekeeper was at considerable expense in the removal of the offensive refuse matter, which may be considered a fair set-off against the increased assessment, besides the improved healthiness of the town, and having a clear magnificent river flowing through the town, instead of a stream turbid with various pollutions.

The production of the land has been extraordinary, and it is admitted that on no irrigation ground have more luxuriant crops been obtained. The Italian rye-grass, mangel-wurzel, and cabbages have been a great success, and the root-crops generally have been distinguished for obtaining prizes at many agricultural exhibitions. Potatoes, parsnips, and other succulent crops, have been cultivated with equal success. The produce has been sold by auction, and has generally realised good prices. For a public body this method of disposing of the crop is, perhaps, the most satisfactory, although a private individual might possibly turn them to better account.

In the tank, rags, paper, and other solid matters are intercepted by a simple grating; and the sewage is then pumped into a cast-iron tower 7 ft. in diameter and 12 ft. in height, from which, by gravitation, it is distributed over the farm. It is first conveyed through covered piping to the land, and over twenty acres along ridges by a 9-in. half-round drain-tile, which is sunk into the ground. The ridge is 12 in. above the furrow, and the sewage-water running over the tile sinks into the land, very little reaching the bottom. The other fields are less carefully laid out, but are watered in like manner from surface furrows along the higher lines; heavy crops are regularly grown.

The effluent water percolating through the banks on the side of the land is perfectly clear and tasteless, and so purified passes into the river. Two engines, of 12-horse-power each, and two centrifugal pumps, are employed at the pumping works.

The length of the main sewer exceeds a mile and a half, sufficiently capacious to serve as a reservoir during the night, and has a storm-overflow, with a self-acting flap. An excessive rainfall will pass without trouble in the night into the river."

Mr. C. N. Cresswell, barrister-at-law, read a paper, in which he said:—

"The opposition of the Metropolitan Board of Works to the Rivers Pollution Prevention Act was disarmed by the introduction of clauses specially exempting the chiefest offender from its operation. Upon what principle, logical or sanitary, is the noblest river of the kingdom thus doomed to perpetual defilement, and the metropolis of civilisation set above the law of the land, like the old 'benefit of clergy' in the days of the Plantagenets? Is it that the enormity of the dereliction takes the case out of the category of sanitary measures? or that a right to foul its own nest has vested by prescription in the City of London? The right of pollution, and the impunity of wilful waste in this case, is the creation of the Legislature, and a political compromise. In others, it is the result of sheer apathy and ignorance combined. It is otherwise in the North, where Manchester and Halifax, Rochdale and Leeds, are grappling boldly with this pollution, and Professor Ansted has shown us that it is more economical to keep excrementitious matter out of drains than to separate the diluted sewage at the point of outfall. If, however, it be found impracticable in our large towns to dispense with water as a vehicle for removing fæcal refuse, can we not learn a lesson from the analogy of nature and the physiology of the human frame? Solids and fluids are poured into the same gullet, and commingle in the same vessel, yet they are separated again before discharge by the secreting organs of the animal body; which things are an allegory not unworthy of the attention of the metropolitan

* Deut. xxiii. 12, 13, 14.

authorities, who were careful by their Act of 1858, both to acquire the powers of taking lands for deodorising sewage, and to define 'deodorise' as including the separation of 'solid suspended matters in sewage' from 'the liquid before the discharge thereof.' It is strange that nothing has yet been done to give effect to these important clauses; but, says Mr. Norman Bazalgette, the doughty champion of the new philosophy of waste, 'The cost will be enormous, and the process a nuisance." We admit the cost, but categorically deny the nuisance. As to the first, it is a question of comparative evils; as to the latter, we have abundant evidence in refutation. Take, for instance, Leeds, which, at considerable cost of money and experimentation, has ascertained the best available method of defecating its sewage, and possesses, if only it be willing to employ it, the means of passing without nuisance a comparatively pure effluent into the river. But the stream flows by still foul and fetid as ever from the upper reaches, changing its hue with each particular dye, and polluted with the refuse of tanneries and cloth factories. What is the use, then, of defecation at Leeds, even if the effluent were as Apollinaris water itself, when all salutary effects are lost in a maze of filth pouring down from the towns above it; and what is the resulting advantage of exacting compliance with sanitary laws from one town, while permitting others to pollute the same stream in a geometric progression of filthiness through its whole course, above and below? Surely this is matter for the intervention of the Local Government Board, if it be minded in all loyalty and thoroughness to do that work which the Government alone effectually can do."

Sir Henry Cole, in reply to a challenge thrown out by Mr. Cresswell to point out a single river which had been relieved of its sewage, referred to the case of Burnley, where General Scott's process was now in operation, making cement worth 40s. a ton out of the sewage, at a cost to the town of Burnley of 2¼d. in the pound on the rateable value.

Dr. Syson thought that Mr. Cresswell took too gloomy a view. It was to be regretted that he mixed up a crusade against water-closets with the subject before the Conference. Surely all who sought to make progress in solving the sewage question must be eclectics, ready to adopt varying means to meet varying conditions. He thought that, in spite of the wrong-headedness of the Local Government Board, there was much cause for congratulation. What would greatly conduce to a satisfactory settlement of the sewage question in many localities would be to give to corporate bodies and local boards some ready and speedy way of acquiring land at a reasonable cost for irrigation, &c.

Dr. Chesshire strongly condemned the use of waterclosets, and spoke of the pollution of the river Tame since Mr. Chadwick and Mr. Rawlinson had persuaded Birmingham to adopt the watercloset system. It was in the house-drains, not in the sewers, that sewer gas was generated.

Dr. Lawrence Hamilton said that a Japanese author, writing eleven years before the Christian era, said: "The disposal of stinking fish is a very difficult and serious matter." The same thing might be said of sewage, and no progress would be made so long as people put their faith in any one particular method of dealing with it. No system was altogether perfect, and no system could be equally well adopted under all circumstances.

Mr. J. Bailey Denton submitted a paper (accompanied by an appendix by Mr. E. F. Bailey Denton, B.A., describing the works in detail) on intermittent downward filtration as applied at Abingdon. He remarked that:—

"Abingdon is a favourable instance of intermittent filtration combined with surface irrigation, and illustrates what may be done in many instances in the Thames Valley and other valleys where suitable soils exist.

At Abingdon, 3¼ acres of land have been prepared—6½ for intermittent filtration, and 27½ for surface irrigation, and the total outlay, including delivering conduit (pipes) as well as chambers and distributing earth carriers, cart-roads, barrow-paths and fencing, wages of clerk of works, and charges of engineer, has not exceeded 2,550*l.*, or an average of 75*l.* per acre. The cost of preparing the land for intermittent downward filtration did not reach 85*l.* per acre, while that of preparing it for surface irrigation cost over 70*l.* per acre, including in each case a proper proportion of attendant charges. The soil of Abingdon is not more suitable than that of Merthyr and Kendal, yet it will be seen that the actual cost is only about one-third of that represented in the report referred to as the case at Kendal.

The deduction to be gained from the mode of disposing of sewage at Abingdon is that where intermittent filtration through suitable soil *per se* is adopted, one acre to a thousand people is ample to secure a perfect effluent."

Mr. Spencer asked whether any ferruginous matter was mixed with the filtering medium.

Mr. E. F. Bailey-Denton replied in the negative.

Mr. Cresswell said that Sir Henry Cole had pointed to Burnley as an instance of what could be done in the purification of sewage; but was that at all a fair citation? Burnley, a town of 60,000 inhabitants, had only 1,000 water-closets. The Rivers Pollution Prevention Bill, which came into operation in August last, was almost totally unintelligible, and was therefore impossible to work.

Dr. Ainley read a paper descriptive of Stott's system for the ventilation of sewers and drains, which consists in connecting sewers and drains with the furnaces of steam boilers, or other furnaces with a strong draught. For this purpose the ashes-place is enclosed by a door, so as to connect the pipe from the sewer or drain in any convenient manner. In all cases, however, it was observed that the connexion must be so arranged that the furnace must only receive its supply of air to support combustion from such sewer or drain, so as to be continually exhausting the sewers and drains of foul gases, which must also pass through the fire and be consumed or rendered harmless.

The author then went on to detail some experiments which had been made by Dr. Angus Smith, with the view of testing the efficacy of the system. He said:—

"The first experiment was made at West Vale, near Halifax; the amount of air passing through the fire was measured by the anemometer, and was 980 cubic feet per minute. The question then was, where does this air come from, or how far? The nearest opening was seven yards from the furnace, and the furthest 300 yards away, and between the two points were fifteen other openings or open gullies. Down each of these gullies the anemometer did not register more than about 20 cubic feet, but the fact was abundantly established that, in all of them, remote as well as near, there was a down current. The whole of these gullies were then made up, not absolutely, but in a rough and ready fashion, and the anemometer placed at the extremity of the sewer, when it indicated 490 cubic feet per minute, thus showing that, with well-trapped gullies, the effect must extend over a very considerable area. . . . .

The Corporation of Halifax then took it up, to see whether such connexion with the boilers of mills would remove the complaints of bad smells from certain neighbourhoods. The first complaint came from one of the best parts of the town; it was loud and strong, the stench rising into some of the houses at certain times being unbearable. Upon investigation the cause was clearly discovered, viz., the passage into the sewers from several factories where wool was washed of the residual liquor after the soap had been extracted by the addition of sulphuric acid. This liquor, I need not say, was peculiarly offensive. The question then was,—Shall we stop the business in which this was made, or shall we find a remedy? As our wish was always to interfere as little as possible with business, we decided to connect the sewers with the furnaces of two of the factories; the result has been that we have not had a single complaint since. I ought to add that several of the complaining houses were half a mile from the factories. . . . .

A number of similar cases could be added, but the story is the same, viz., complaints which have found their remedy, thorough, effectual, and simple, in the connexion, on Stott's principle, of the sewers with the furnace of some factory or other furnace having a strong draught."

Mr. Allcock, of Sunderland, said that a good system of sewers was of no use unless the house-drains were properly laid. A great number of dwellings in the suburbs of our large towns were "run up" for sale by speculating builders, most of whom paid not the slightest regard to the proper laying of the drains. For this reason he thought the laying of the house-drains ought to be done by the local authorities themselves. By such an arrangement, the work would not only be properly done, but it would be done at about half its present cost to the property owners. The speaker suggested a resolution on this subject, and undertook to draft one for submission to the Conference.

Dr. Elliott said our ancestors very wisely kept their privies out of their houses; but we in the present age, who assumed to know so much more than our forefathers, brought the water-closet (in some respects equally if not more dangerous to health than the privy) inside our houses. What was needed was that all water-closets should be thoroughly ventilated, and cut off by fresh air from our houses, by means of open lobbies giving convenient access. It was also important that all water-closet apparatus should be automatic, and capable of taking care of itself.

Dr. North, medical officer of health, York, spoke strongly in favour of transferring to local authorities the work of laying the house-drains, at the charge of the property-owners. It was of the utmost importance that drains passing beneath the floor of a dwelling-house should be completely impervious, for subsoil laden with sewage emanations was little better than a cesspool.

After a few remarks from the chairman (who pointed out that in his opening address to the Conference two years ago he had strongly dwelt on the necessity of enacting that the house-drains should, for the reasons mentioned, be laid by the local authorities), the first day's proceedings of the Conference were brought to a close.

The Conference re-assembled on Friday, the 24th inst., when the following resolutions were unanimously agreed to:—

Moved by Mr. Allcock, and seconded by Mr. Ernest Turner:—

"That, in the opinion of this Conference, the benefit to large towns of a well-devised and effective system of sewers is very often entirely neutralised by the careless and improper way in which the house-drains in connexion with such sewers are laid and connected with the soil and waste pipes of the house. That all drains intended to be connected with the sewers of a Sanitary Authority ought to be made by such Authority (in the same way that house-services are made by gas and water companies to their mains). That powers as extensive as those contained in the 11 & 12 Vict., cap. 112, with corresponding duties, should be conferred and imposed upon all local Sanitary Authorities, including those in the metropolis. That the Society of Arts be requested to urge these views upon the president of the Local Government Board by deputation or otherwise."

Moved by Mr. Cresswell, and seconded by Captain Douglas Galton:—

"That this Conference desires to record its opinion that further legislation is needed, especially with regard to the constitution of county boards, with a view to strengthening the local government organisation; and authorises the President, in conjunction with the council of this Society, to bring the matter before her Majesty's Government, in such manner as he and the council may deem to be most expedient."

We must break off here for the present.

BOLTON INFIRMARY COMPETITION: AWARD.

FROM the thirty-seven designs submitted, the building committee took out fourteen, bearing the following mottoes:—"Thorough" (enclosed in a circle), "Esculapius," "Simplex Munditiis," "Lancet," "Red Cross," "Alpha," "Light" (in a circle), "Sanitas" *(a)*, "Health" (enclosed in a double triangle), "Light," "Thorough" (enclosed in a triangle), "Westminster," "Health," and "Sanitas" *(b)*; and these were referred to Mr. Charles Barry, F.S.A., to select the designs to which the first, second, and third premiums should be awarded. Mr. Barry places the design bearing the motto "Red Cross" first; "Sanitas" *(a)* second; and "Thorough" third. On the sealed envelopes being opened it was found that the first premium (50*l.*) had been gained by Mr. R. K. Freeman, of Bolton; the second (30*l.*) by Messrs. John Ladds and W. H. Powell, of London (the latter being a nephew of the Vicar of Bolton); and the third (20*l.*) by Mr. J. H. Proctor, also of Bolton.

Mr. Barry, at the end of his report, makes the following general observations:—

"In concluding my report, I hope the Committee will excuse my offering a few remarks upon the instructions to competitors, and which I should have ventured to submit to them had I been consulted at the outset.

First. I have a strong opinion that in such cases the first premium should not merge in the commission of the chosen architect, since the labour of getting up an elaborate set of competition drawings, such as those submitted in this case, will not be overpaid even by the amount of the first premium; and it is, besides, a common experience among architects that beyond settling the main principles of a design, competitive drawings are quite useless in the eventual carrying out of the work. The planning and arrangements have always to be considered anew between a committee and the architect when chosen, and when he is brought for the first time in contact with his employers as their confidential and responsible adviser. Even the architectural design in a large majority of cases is frequently quite changed before the work is actually commenced.

Secondly. I notice in the instructions something of an intimation that whatever the cost of the building, the architect employed is, under no circumstances, to receive for his services, from first to last, more than 800*l.*, or 5 per cent. on the outlay contemplated by the committee, viz., 16,000*l.*, which was, I presume, named by them having regard to the means at command, but of course, could have no reference to a design which was indeed afterwards to be prepared, and which, if approved, might be carried out. I assume that of course the meaning of the committee necessarily must be that 5 per cent. will only be paid on any expenditure (whether less or more than 16,000*l.*) which is made with their previous sanction, and such a stipulation would be most fair and proper.

Thirdly. I trust the committee will not hesitate to employ as their architect the author of the design which shall receive the first premium (unless indeed some moral or equally cogent reason to the contrary shall appear), remembering that in all cases of architectural competition the incentive to competitors is not the premium, which can seldom do more than pay the actual cost of producing the drawings sent in, but the professional credit which may be expected to result from a meritorious design well carried out by its author and identified with his name."

THE WATERWORKS OF VERVIERS.

ABOUT five English miles from the German manufacturing town of Eupen, close to the Belgian frontier, three miles from Dolhain, the busy suburb of Limburg, and nine miles from Verviers, during the last few years an engineering work has been in course of construction of such importance as to be styled by visitors "the eighth wonder of the world." Beholders are not wrong in thus describing the vast undertaking, for modern engineering skill, aided by nature, has here produced a lasting monument of human enterprise. We present our readers with such details as we have been enabled to gather from a paper of Herr Postdirector Rutsch, of Aachen, a gentleman well acquainted with the district, and the author of a book on the neighbourhood of Eupen in its geographical and historical aspects, to which are added extracts from the history of the former duchy of Limburg.

The idea of damming up and collecting large masses of water for special purposes is not of modern origin, and found formerly practical application, especially in hot countries, the soil of which was extremely fertile of itself, but the productiveness of which was rendered difficult by a scarcity of water. In Europe this mode of making large tracts available for agricultural purposes was introduced by the Arabs, first into the south of Spain, and later into France. Saint-Étienne, in the latter country, and Verviers, in Belgium, were the first to construct great hydraulic works for assisting and raising a flourishing branch of industry still further by storing up water or conducting it to a certain locality. Madrid, also, has made use of water for such purposes.

The manufacture of cloth, as well as the preliminary treatment which wool has to undergo before being made into cloth, at Verviers, requires a large quantity of pure water, which, after its use, is returned to the river in a dirty state unfit for further utilisation. This evil naturally increased with the growth of the industry, and led to just complaints on the part of the inhabitants of Verviers and its neighbourhood—complaints only too frequently heard also in this country from the manufacturing centres. This grievance could not be left unattended to if the pursuit of this branch of industry was not to be seriously affected by the emigration of the population from a place where they were unable to obtain one of the principal necessities of life,—water. Experiments to alter this state of things by improving the Vesdre (the principal river of Verviers, and a tributary of the Maas) led to no practical results, or contributed at least very little towards the desired object of removing the nuisance, for the principal reason that at certain times of the year the river does not contain water enough for the purpose.

The Belgian Government, consequently, commissioned, as early as September, 1857, M. Bidaut, Chief Engineer of Mines, to work out a plan by which the various requirements could be effectually met. His scheme was submitted in December, 1859. M. Bidaut had been guided, in drawing up his plan, by several examples, one of which was that of Alicante, in Spain, the value of which has been proved by three centuries, utilising the principal features in drawing up his plan.

The neighbouring town of Eupen, in the interest of its similar but much older industry, which required the same agency to raise it, on being informed of the scheme, willingly gave in its adhesion. But for several reasons the co-operation of that industrious town fell to the ground. On the one hand, the amount of its contribution was considered too high, the Prussian Government, on being applied to, declining to give State aid to the town. On the other hand, the serious apprehension to which the fearful Holmfirth flood, in 1852, caused by the bursting of the Bibury reservoir, near Huddersfield, and then still fresh in men's memories, gave rise, was still further increased when, twelve years later, and when the Verviers scheme was under full discussion, the Bradfield reservoir broke down, and flooded Sheffield and the country twelve or fourteen miles round, entailing a loss of about 250 lives, and doing damage estimated at 327,000*l*. This latter disastrous occurrence had a most deterrent effect on the inhabitants of Eupen; they declined to participate in the work, and their co-operation was therefore relinquished.

Meanwhile, the town of Verviers had had under consideration the fact that a regulation of the Vesdre above the town of Eupen, and the conduct of water the pollution of which by the use made of it by Eupen for manufacturing purposes was inevitable, would interfere most seriously with the object of Verviers. For the latter town it was a question not only of obtaining a sufficient quantity of water all the year round, but also of getting it in a sufficiently pure state. Verviers had come to the resolution to shift for itself. To this it should be added that the original calculations as to its requirements were erroneous. Instead of 3,000,000 cubic mètres (660,290,000 gallons), 14,600,000 cubic mètres (3,214,000,000 gallons) of water were wanted per year, or 40,000 cubic mètres (8,800,000 gallons) daily.

A most essential condition in the manufacture of good cloth is to provide a pure water free from lime, and it is one of the important peculiarities of the place by which the manufacturers of Eupen have obtained world-wide renown that the Vesdre contains only such water. The Vesdre rises in the High Venn, and obtains its supplies exclusively from the layers of peat of that mountain chain. Its three tributaries,—the Hill, the Soor, and the Gileppe,—have the same origin; the first two joining the Vesdre at Eupen, the Gileppe entering that river at Goë. The Gileppe was selected by the town of Verviers in carrying out its scheme, because it not only rises on Belgian soil, but because its course is entirely within the frontiers of Belgium; while the Hill and the Soor touch Prussian soil. The Gileppe, also, was the river nearest to Verviers. Those reasons caused M. Bidaut to take in this valley observations in 1864 and 1865, with a view of ascertaining whether the quantity of water brought by the Gileppe would be sufficient, and whether the formation of the valley and the nature of the rocks were suitable for forming a vast reservoir; whether, in fact, there were sufficient guarantees in both directions. The results were submitted by M. Bidaut to the Minister of Public Works in a report dated May 8, 1868, after, in the month of February, 1867, arrangements had been made for beginning the sinking of a shaft and of galleries. On April 19, 1869, the works for damming up were begun by Messrs. Braive & Caillet, the contractors undertaking to complete them some time in 1874. This term was, later on, prolonged until November 1, 1875. On May 9, 1875, the sluices were closed for the first time, and for the first time the waters of the Gileppe began to collect behind the dams.

After the difficult problem of ascertaining what is the height of large quantities of water of a dammed-up river compared with a fixed annual requirement had been solved by M. Donckier, it was necessary to find out whether it would be more advantageous to collect the water in one or several reservoirs. Investigations have shown that the price of a cubic foot of space is considerably reduced by the height of the dam. In the valley of the Gileppe the reduction of height by one-third leads to the reduction of the quantity accumulated by two-thirds. Consequently, calculated for the several places separately, a single dam of 147 ft. 6 in., or four dams of 95 ft. each, were required for the accumulation of 2,641,160,000 gallons of water.

The sole reason that could have been urged in favour of several reservoirs was the danger involved in constructing dams of too great a height. But it must be taken for granted that the possible bursting of one of several reservoirs would lead to similar disastrous consequences, in so far as it would prove as destructive for the walls behind it. The sudden pressure of the water, not calculated, would be sure to cause the bursting of the other reservoirs. On the other hand, it is much easier to find a single locality offering all the guarantees of solidity than several of them. Besides, dams of 147 ft. 6 in. have been used in other places. That of Alicante exists already for three centuries, and measures 134 ft. 6 in.; others are known of 164 ft. high. The selection of the site depended upon the firmness of the geological formation and the resistance to pressure of the rock, regard being also had to the fact that in a narrow valley the dam to be constructed is shorter and consequently more capable of resistance. The dam closing the valley of the Gileppe has a height of 154 ft. Two outlets, 1 ft. 6 in. below the roads, hinder the water from rising to the top of the embankment, so that its level will be maintained at 147 ft. 6 in. The lake thus formed up the valley by the dam covers an area of nearly 198 acres, and contains 2,693,744,708 gallons of water.

Besides the embankment wall proper, the principal works include the two outlets mentioned, and two subterranean galleries for executing the water conduits. Each gallery contains a shaft which has served originally in making the shore cutting, and through which at present the dispositions for the sluices are carried on. The galleries leading to the water conduits have played an important part during the operations, having served during that time for carrying off the water. The work of excavating the galleries preceded all the other works, partly on account of carrying off the water during the progress of the works, partly also because during the operation of driving the galleries the formation of those rocks which enclose the reservoir could best be observed. Those works showed regular vertical layers of sandstone, slate, and psammite in the proportion of 64, 19, and 17 per cent. In a single locality up the valley, and distant nearly 400 ft. from the left gallery, a poor vein of lead ore and gravel was met with.

The embankment wall contains on both sides a series of steps, each a foot high, which form a sort of stairs of communication between crest and base. The summit of the embankment, of a width of 50 ft., serves as a means of communication for the two shores of the basin, and has a paved roadway 23 ft. wide, and two footpaths, each 13 ft. wide. The sides are of ashlar-stones. On the outer edges are parapets of square blocks of masonry 21 ft. 6 in. long and 2·6 ft. thick, with a coping of ashlar, distant from each other 42 ft. 6 in., the intervals being filled up by wrought-iron railings.

The principal foundation-walls of the embankment are in masonry of coarsely-hewn freestone and rough quarry-stone, the ballasting of hewn quarry-stones. The abutments, which form the base of the embankment at the junction, are in ashlar-stone, as well as the course carrying the dressing. The cubical contents of the masonry of the embankment amount to 8,775,110 cubic feet. The ashlar-stones are so-called "small" granite. The hewn quarry-stones of the dressing are taken from layers varying in thickness between 1 ft. 6 in. and 1 ft., and are laid alternately lengthwise and broadways throughout the whole wall, or with 2 ft. and 1 ft. 4 in. towards the outside.

In place of a road formerly in the sole of the valley, one has been constructed on the left side, which crosses a stone bridge, ascends the left hill alongside the outlet, and then follows the shore of the lake.

The works described have been carried on at the expense of the Belgian Government; all the preliminary works at the expense of the town of Verviers. A subsidy of 8,000*l*. was granted to the town as a part of the expense incurred in the preliminary works for the regulation of the Vesdre.

The aqueduct which carries the water of the Gileppe to Verviers commences about 558 ft. from the base of the embankment. Its width is 6 ft. 6 in.; the piers, joined by vaults, have a height of 5 ft. The aqueduct runs through the district of Jalhay, crosses the valley of the Borchêne, passes Goë, Limburg, Stembert, and ends in the neighbourhood of Verviers near Les Roches in a distributing reservoir. Its whole length is 5½ miles; its fall is 3½ in. per mile. The damming up of the Borchêne, the waters of which are taken up by the aqueduct, consists of an embankment wall joining the two sides of the valley. The wall measures in its longitudinal axis 108 ft., has a breadth of 9 ft. 3 in., and a height of 19 ft. 6 in. below the crest.

The Closet Air Escape.—With reference to your notice of the "Closet Air Escape," allow me to say, it appears to me very valuable, in proof of which I would not sell my tube for 100*l*., unless I could procure another. As an encouragement to invention, it may be added that such an instrument would be invaluable in hospitals for the use of patients confined to their beds; for, by having the tubes carried up to the roof, they could inhale the purest air for hours by day, and even in the night when awake. They would thus escape in a good measure what has been called by Dr. Druitt "the contaminating air of the wards of hospitals," and in exchange receive the powerful tonic effects of fresh air. Patients coming out of a hospital, having been discharged cured, have described their feelings as almost intoxicating, such was the effect of fresh, pure air.—*C.*

RADLEY.

PUBLIC SCHOOLS OF THE PERIOD.

WHEN the history of the nineteenth century comes to be written, and its social features analysed, not one will stand out more prominently than the growth of the public schools of the Victorian era. By the public schools of the Victorian era, we mean those which have been created during the present reign, as distinguished from the five older foundations, Eton, Harrow, Rugby, Charterhouse, and Westminster. They present features in which they differ conspicuously from the two first of the ancient public schools of England, and they equally are distinct from the grammar schools, which are likewise of very ancient standing. It would be an interesting topic, indeed, to follow out at some length the causes which have produced this growth, and the consequences which these new educational creations have produced, both in an educational and in a social point of view. Their effect in diffusing scholarship and education, *esprit de corps*, and manliness among the middle classes has been great, and they have and do stand as witnesses that gentlemanly feeling and scholarship can be combined in these smaller educational centres, and as protests against the luxury which is becoming so marked a feature of the two great metropolitan schools, Eton and Harrow. None of these Victorian schools is more worthy of note than that which stands at the head of this paper—St. Peter's College, Radley, founded in 1847, which, to all appearances, increases in prosperity and in usefulness as the years pass on.

It would be difficult to find a spot more suited to a school than that on which Radley College is placed. It is situated on the summit of the range of hills which forms the northern boundary of the Valley of the Thames as it winds down from Oxford past Sandford and Nuneham to Abingdon. Thus climatically it is admirably placed in a dry and bracing spot, freshened by the breezes from the Berkshire downs. The level plateau in which it stands serves for all the athletic exercises which are required for a school, and since it is but little over a mile from the Thames there is every facility for boating. The nucleus of the school buildings is formed by what was once Radley House, the family seat of the Bowyers, who succeeded to the manor of Radley in 1792, on the death of the last baronet of the line of Stonehouses, who in their turn had purchased this property in 1575 from the Abbot and Convent of Abingdon. It is a fine structure of red brick with stone facings, and built with admirable solidity. On the west side there is a fine view over the Vale of White Horse, with the graceful steeple of Abingdon Church peeping from among the trees in the middle distance. On this side of the house are a fine suite of rooms opening on to a terrace, a large central apartment, and two smaller ones on each side, which serve as the dining-hall. In addition, in their good proportions they are noticeable as containing a large quantity of old oak panelling, and the centre room contains a mantelpiece and superstructure of really very fine old carving. Indeed, the whole house abounds with old oak,—a very fitting adornment for a school-house. The remaining rooms in the house are occupied by the warden and his family, or by some of the undermasters. Another feature of some interest is the spiral stone staircase which runs from the basement to the attics in the centre of the house, and opens on to the landings of the main staircase by what were, in all probability, at one time trap-doors in the walls. Now, of course, it is used more or less as a back staircase, but it was in all likelihood at one time a secret staircase not intended for general use.

It was of course necessary, when this building was employed as the centre of a number of other school buildings, to devise some means whereby it might be connected with the other buildings. This has been done by means of a covered passage leading from the south side of the house, and connecting it with the chapel, the schoolroom, class-rooms, and dormitories. The main objection to a passage of this kind is its temporary appearance and inferiority, from the picturesque point of view, to a good brick or stone structure. On the other hand, it is a great advantage in a growing school to have ample opportunities for expanding as more accommodation is required.

This passage leads, as we have said, to the chapel, which is a plain brick structure, oblong in shape, with a high-pitched roof, coming to a very acute angle at the summit. The most noticeable features in the chapel are, first of all, the fine organ, and, next, the sculptured reredos of wood, covered with gilding,—a very excellent piece of wood-carving; lastly, there is much good and quite modern carving in the panels, desks, and seat-backs. The effect of the whole is to give an appearance of harmony, and even of richness, to the interior, were it not for the bare flatness of the white walls.

The next building which should be noticed by the visitor to the school is the dormitory, which is divided into a ground and first floor. It is a large and very lofty building, and is divided into cubicles, ranged on each side of a broad central passage, at one end of which is a large window, and at the other a main door. Each cubicle is separated from the other by a wooden partition about 7 ft. in height, and a curtain drawn across the end when the occupant is using his cubicle. Each of these compartments is about 12 ft. by 6 ft., and is capable of holding a small bed, washing-stand and cupboard, and table, and there is room for the morning bath by the side of the bed when it is used, whilst at other times it disappears beneath it. There are, of course, differences of opinion as to the value of this cubicle system; but, taken as a whole, it is, we think, the best system for large schools. For it has the great merit that it enables each boy, however young and however low down in the school, to have a place where he is absolutely and completely private, and the greatest value is attached to this privacy by every boy, whether of a shy disposition or not. The system of rooms in which two, three, or more boys sleep takes away this privacy. A boy may wish to go to his room to read home letters, and what not, and he cannot be alone, whereas even when it is not permitted to go to the dormitory without leave, yet when there the boy feels that his cubicle is his castle. Thus it serves as a protection to weak or shy boys, and it prevents the ruder and rougher spirits from developing that spirit of teasing which so easily degenerates into bullying. From another point of view it is a valuable system, for it enables boys to sleep in a lofty and well-ventilated apartment, it enables a uniform heat in cold weather to be maintained, and economy to be practised by the use of hot-water pipes laid through the building, and it is possible to have a through system of ventilation,—most valuable during the summer time. Added to this it enables much more systematic arrangements of a sanitary domestic kind to be made. There is no carrying of water into one room and then into another. There is one large apartment, with all the apparatus for obtaining water and so forth on the spot. Indeed, when the system of dormitory cubicles and the house system come to be compared, it is obvious that, from every point of view, the house system must go to the wall. The real system for a school is undoubtedly to have a dormitory for sleeping purposes, a separate set of rooms for studies, and a house or houses for married masters.

But to pass on. The next room to be noticed is the large school-room, which, however, may be passed by without further remark than to mention more old oak panelling and the fact that it is a long room, with class-rooms leading out of it.

Another building, however, should not be overlooked, namely, the Gymnasium, a large building, or, rather, structure, of metal, erected in the shape of a Latin cross without its upper end. Thus what in a cathedral corresponds to the nave forms the exercising part, or, more properly, drill-space; while the space which answers to the transepts and part under the central tower is filled with the various gymnastic apparatus, such as ladders, vaulting-horses, and so forth. The whole is painted inside with bright, cheerful colours. This, again, is a building which every school should possess. It serves on some occasions as a concert or banqueting hall; but it is always there for use on wet days, though it is not the kind of building which can ever be used without some supervision, as boys are apt to play dangerous tricks with gymnastic apparatus. But its proper use, as at Radley, is for systematic instruction in gymnastics in regular classes, under the superintendence of Mr. McLaren, of Oxford, and next for use when required by individual boys.

There are, of course, other buildings which might fairly claim to be noticed if our space permitted, such as the hospital and fives courts; but we have sufficiently indicated the main features of the place as they will be found amidst the large elms, the drooping laburnums, and the fragrant lilacs which grow so luxuriantly around.

Certainly, indeed, these modern schools, of which we have taken Radley as a very favourable specimen, have many advantages which even the great names of Eton and Harrow lack, for they unite at present comfort without luxury, abundant means of athletic pastimes without a sacrifice of the intellect, and, in many respects, as in the case of Radley, they are placed in spots where the fairest of English scenery is to be found. Patriotism is composed of a number of complex elements,—love of relations, of friends, of homes, and certainly of schools,—and we can hardly doubt that, not only a love of a school, but a love of the country and a country life, is largely increased if schools are surrounded by that gracious and pleasant aspect which the landscapes of England wear from April to October.

RECONSTRUCTION OF THE GAIETY RESTAURANT.

AN exceptionally-difficult work of building construction has been in progress at the Gaiety Restaurant in the Strand and Catherine-street, during the last six or eight months, and although what may be regarded as the heaviest portion of the work has been accomplished, much yet remains to be done before the undertaking is completed. The works have involved the entire rebuilding of the lower portion of the structure, including the main outer walls, from the basement to the first floor level (a height of 32 ft.), without disturbing the upper parts of the fabric. In order to effect what was intended to be carried out the upper portion of the building had in the first instance to be supported on needles, with strong uprights, 14 in. square, carried up from the basement. Above these, counter-needles, 12 in. square, were then erected, with the view of easing those below, and iron girders were thrown across the entire width of the building at the first-floor level. This preliminary portion of the work having been effected, the outer walls, from the basement to the first-floor level, together with the whole of the interior walls, were cleared away, the whole of this part of the building having been, so to speak, gutted. The work of reconstruction then commenced, the Catherine-street and Strand frontages being carried up on piers from the basement, supported from the street level on blue Pennant bases. The piers are in white Suffolk brick, built in cement, and backed up by cast-iron stanchions, which carry the first-floor girders. These piers are 2 ft. 6 in. wide by 2 ft. thick, the dimensions of the windows between the piers averaging 14 ft. in height by 7 ft. in width. The piers are surmounted at the first-floor level by shafts in Mansfield stone at each angle, with carved Portland stone capitals. All the inner walls having, as already stated, been cleared away, the basement, ground floor, and first floor, have each been converted into spacious apartments of uniform dimensions, their size being 100 ft. in length, by 33 ft. in width. The basement is 11 ft. 8 in. high, the ground floor 22 ft. (to effect which a mezzanine floor has been removed) and the first floor to the ceiling 14 ft. The basement is intended to be fitted up as a grill-room, the ground floor as a buffet, and the first floor as a main dining-room, and each of these several apartments will be handsomely decorated.

Internally the upper portions of the building have, to a certain extent, been likewise reconstructed. In order to extend the first floor to the same dimensions as the ground-floor below, it was necessary to remove some of the inner walls and other structural portions of the building, and in place of these the building at the second floor has been strengthened by girders weighing nine tons each, with strong vertical iron shafts tied to them, which are carried up to the top of the structure. The third and fourth floors have also been entirely reconstructed internally, with great strength, iron having been largely introduced. When completed the building will contain a large number of private dining-rooms, ladies' retiring-rooms, and other apartments. The works have included the removal of the original principal staircase, from the ground to the third floor, and in its place a new staircase has been erected, 24 ft. by 19 ft., which will be approached by a new entrance in the Strand, on the west side of the entrance to the Gaiety Theatre. On each side of this entrance, and also in the centre, there are polished Aberdeen granite columns, resting on blue

Pennant stone bases. In connexion with the works several hydraulic lifts are in course of construction for the purpose of conveying food and stores to and from the upper parts of the building.

Mr. Verity, of Regent-street, is the architect; and Messrs. G. Smith & Co., of Pimlico, are the contractors. Mr. Warburton is clerk of the works, and Mr. Munday the general foreman. The cost of the works when finished is estimated at about 12,000*l.*

THE TELEPHONE HARP.

SOME experiments on this newly-invented instrument, made last week in the Gaiety Theatre, on the occasion of some agreeable performances in aid of the Shakspeare Memorial Theatre at Stratford-on-Avon, have scarcely received from the daily press the amount of attention they well deserve. Before alluding to them, however, let us say briefly that the entertainment, which was originated and carried out by Miss Kate Field, who enlisted in the undertaking a number of well-known actors and actresses, proved eminently successful, and will add, we understand, some 400*l.* to the memorial funds. Passing, then, to the telephone harp, this was played in Stratford, say 120 miles away, and heard in the Strand; we heard it ourselves, and the whole house heard it; identifying the airs and loudly applauding. The use of the wire was afforded, we believe, by the Great Western Railway Company. There were three telephones in the theatre, one on each side of the proscenium at the level of the balcony stalls, and the third in the centre of the balcony-front. It occupied about eight minutes (after the inventor, who addressed a few words to the audience, had left the stage), to exchange signals with the harpist at Stratford, and then the music began, and was heard more or less distinctly by the whole house. It was nothing short of an astounding incident, but we are so used to wonders that we take them too much as a matter of course. What will be the practical outcome of the extraordinary group of acoustical inventions lately made no one will yet venture to say. In their history, when written hereafter, this experiment at the Gaiety Theatre must have a place.

A NEW PAROCHIAL MISSION HALL AT NEWINGTON.

LAST week, the Rev. W. D. Maclagan, Vicar of Kensington and Bishop Designate of Lichfield, laid the foundation stone of a new parochial mission-hall, which is about to be erected in connexion with the parish of Newington, of which the Rev. Dr. Maclagan was rector before his appointment to the vicarage of Kensington. The building is Gothic in character, the south elevation, facing the church, being surmounted by a gable, beneath which are three large windows, with a range of similar windows along the west frontage. The materials are stock brick, relieved with arches and bands of red brick. Internally the building will have an open timber roof, ceiled at the collars. The hall will be 68 ft. long and 40 ft. broad, and will be capable of seating 400 persons. Externally it will be 38 ft. high to the ridge of the roof. Attached to it are a committee and class room, and on the west side is a corridor 6 ft. in width, from which the hall is entered.

The architect is Mr. J. Edward Cutts, of Southampton-street, Strand, and Messrs. Downs & Co. are the contractors.

To Destroy Worms on Lawns. — The *Journal of Forestry* gives the following mode:—Dissolve one ounce of corrosive sublimate in a pint of hot water, adding two large handfuls of salt. When dissolved add nine gallons of cold water, then water the lawn with a common garden watering-can through a rose. Nine gallons will go over 800 square yards, and should be applied immediately after rain, when the worms come up near to the surface of the ground. The application will make the worms appear on the surface, when they can be picked up by hand, or swept up with a broom, taken away, and destroyed, care being taken not to put them in the way of ducks or poultry. The lawn should be well rolled immediately after the operation. Lawns done over three times, from October to March, will have a beneficial effect in keeping the worms quiet during the summer season, when lawn tennis, croquet, and bowling are enjoyable.—C. C.

MR. FERGUSSON ON THE BUILDINGS IN THE HARAM AREA AT JERUSALEM.

WE are enabled to reproduce in our present number some of the illustrations accompanying Mr. Fergusson's remarks, in his recent volume (noticed briefly in the *Builder* of the 4th ult.)* on the Dome of the Rock, and other buildings in the Haram area at Jerusalem, with reference to his theory that the Dome of the Rock is identical with the church erected by Constantine on the site of the sepulchre of Christ, and that, therefore, this, and not the Church of the Holy Sepulchre, is the true burial-place. With the help of these illustrations, we are able to consider a little more fully the facts and arguments upon which this much-contested theory is based.

Almost the one point on which all parties are agreed is that Constantine did build, on the site of what he believed to be the sepulchre, a church in commemoration of the Resurrection, and that in order to uncover the site of the sepulchre he had to remove a heathen temple which had been built over it. The fact of his building the church, since it is in every way probable in itself and attested by historians (Eusebius in particular) in the most positive manner, there seems not the slightest reason to doubt: so far, there is a fixed *point d'appui* for the argument. Most of those concerned in the question (Mr. Fergusson included) seem disposed to agree that Constantine must have known the true site of the sepulchre, and that, therefore, if we find out where he built a church, we fill up the gap of three centuries between his time and the Crucifixion, and have arrived at incontestable evidence as to the place of the entombment. We are hardly disposed ourselves to regard this as a necessary conclusion. Three hundred years looks a short time when we regard it over the long perspective of centuries that separate us from the Christian era, and when we consider it from the point of view of a modern historian, with all his resources in regard to literary evidence and records, we might very well think that it was too short a time for an utter falsification of topographical fact to have been developed. But if we consider what three hundred years was in those days of tradition and credulity, when mankind were so quick to believe whatever they wished specially to believe, and when so many legends, of far more formidable character than the mere question of the site of a tomb, took form and substance in less than a century, so as to be implicitly received and accepted as historical, we should hesitate very much to accept any site as unquestionably fixed merely because it is proved by architectural evidence that Constantine and his contemporaries regarded it as the true site. The very account of the disclosing of the sacred site by the removal of the heathen temple, as given by Eusebius, is so obviously pervaded by enthusiastic exaggeration as at once to raise doubts as to the reliability of his evidence on such a point.

We allude to this side of the question because we think it as well that there should be a check upon the *quasi*-religious feeling which has turned this into a matter almost of theological or ecclesiastical controversy, accompanied by more than the average amount of theological ill-will (not to use a stronger phrase) which is always imported into such arguments. For some centuries past the building called the Church of the Holy Sepulchre has been accepted as traditionally the successor of Constantine's building, although every trace of the latter had, as every one admits, disappeared. But still the site generally has been accepted as the correct one, and consequently has been to a certain extent a centre of devotional interest even to those who, not giving the reins to superstition, or pretending to accept all the holy places and things supposed to be included within the walls of the Holy Sepulchre church, have yet felt a very natural interest in regarding this as at least marking the true burial-place of the founder of Christianity, and therefore the centre of many sacred and endearing associations; and the feeling in regard to Mr. Fergusson, when he first propounded his theory, was not an archæological so much as an ecclesiastical and religious indignation against a critic who had wantonly endeavoured to shake the faith of many generations of men as to the site of the events in which they were most interested. The two most uncompromising opponents of his theory were the late Rev. Geo. Williams, a high-church clergyman, who wrote in the sentimental manner of his caste in regard to the holy places at Jerusalem, and the Comte de Vogüé, whose feelings were likely to be still more influenced in the same kind of direction by the fact of his orthodox Roman Catholic persuasion. He, in fact, denied that the Dome of the Rock theory was worth controverting at all, characterising it as one of those theories which "one does not refute." The spirit in which the proceedings of the Palestine Exploration Society have been carried out, and the results described, has been marked by a good deal of the same theological tendency,—the desire to find facts in accordance with certain accepted traditions. But so far as the question of the place of the entombment is concerned, which is the chief traditional question affected by Mr. Fergusson's theory, it appears to us idle to suppose that any certainty can be arrived at, or that even the unquestionable proof that certain remains were those of the church built by Constantine over the supposed burial-place would prove that Constantine was correct, and that we had arrived at an unquestionable topographical fact. The time is too far removed, the age was one too much under the dominion of credulity and excitability of belief (if one may use the phrase), for there to be any firm basis to go upon. The wisest thing, therefore, is to quit altogether the idea of the reality or unreality of any sacred site being affected by the controversy, or any wound given to any one's religious faith. On that ground there are no certain data to go upon one way or the other. The question between Mr. Fergusson and his opponents is one purely of architecture and archæology; in that sense of no little interest, but one which there is not the slightest occasion to confound with questions of religious faith or of what may be fairly called credulity as to religious topography.

But the fact is that the less credulous or sentimental writers on the topography of Jerusalem have already given up the Church of the Holy Sepulchre as the site of the entombment, simply from the impossibility of reconciling its position with the narrative of the Evangelists. Wherever the scene of these events was, it is at least certain that it was not within the city, and the Holy Sepulchre site is almost unquestionably within the city as it existed at the Christian era. It is next to impossible, therefore, that the Church of the Holy Sepulchre can represent the site of the tomb, or even the site which Constantine supposed to be that of the tomb, since in his time it cannot be doubted that there were data sufficient to avoid making so complete a mistake as to take a site within the city area for an event known to have happened outside of it.

It is obvious, therefore, that there can be no foregone conclusion in the case; that we are quite at liberty to look for the relics of Constantine's church elsewhere, if we find anything which, in its position or style, suggests such an origin. This is what Mr. Fergusson asserts that the building called the Dome of the Rock does suggest.

Of the two principal buildings in the Haram area used as places of Mahommedan worship, the one, the Mosque El Aksa, is an obviously Saracenic building, with the usual plan of a Mahommedan church, — a parallelogram with a flat wall on the side opposite the entrance; the other, the Mosque of Omar, otherwise called the Dome of the Rock, is an octagonal building with an octagonal arcade enclosing an inner circular arcade, from which rises a dome. The dome is obviously Saracenic in form, construction, and ornamentation. But the plan of the building is such as is never known to have been used for any Mahommedan place of worship in any other instance. The usual theory has been that both were erected at the same time, towards the latter part of the seventh century, by the Mahommedan conquerors, who adopted the eminence on which these buildings are situated, and where the Jewish temple had formerly stood, as their peculiarly holy place. But no explanation has been given why there should here be a building professing to be built as a Mahommedan church, but differing entirely in plan from the usual form of such a building.

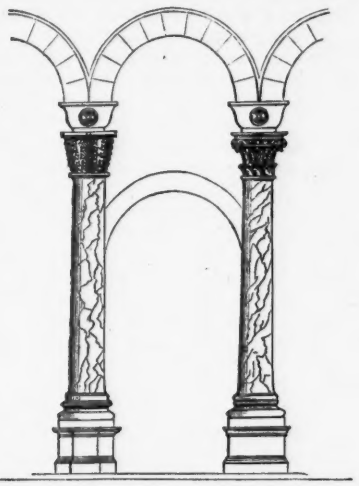
Had not the enclosure of the Haram area been so scrupulously guarded from the intrusion of "the infidel," it is probable that the correctness of this view would have been questioned before now. It is only a comparatively short time since that Messrs. Catherwood and Arundale contrived to overcome the religious intolerance

* The Temples of the Jews, and the other Buildings in the Haram Area, at Jerusalem. By James Fergusson, esq., D.C.L., F.R.S., &c. London: John Murray. 1878.

of the followers of the Prophet, and to obtain permission to see and make drawings of the sacred buildings. Although at that time the state of archæological knowledge in regard to architectural styles, and their bearing on history, was much inferior to what it is now, and though Messrs. Catherwood and Arundale entered on their labours in the full conviction that the "Mosque of Omar" was what it professed to be, even they seem to have been struck by the Classical character of some of the details of the building before them. But in the present state of knowledge among those who give any study to architectural history, it seems impossible that any one possessed of adequate information could look for one moment even at the two small and not very exact views of the two interiors which we reproduce * (see illustrations on page 564, figs. 2 and 3), and not at once repudiate the idea that they were the work of the same time, and the same hands and minds. The distinction is intensified when we examine and compare the enlarged drawings of the two capitals. If we are to suppose that Moslem architects at the close of the seventh century produced that capital (fig. 4), we had better, as Mr. Fergusson suggests, "burn our books, and give up at once all idea of ascertaining the age of buildings, either Gothic or Classical, from their style." The capital is very nearly a Classical one, only modelled in a rather stiff and poor manner. But in the other drawing of the capital and entablature, which we are able to give (fig. 1), we get still nearer the precise date of the work, for we here actually see the first attempt at thickening out the upper part of the bell of the capital to give greater apparent strength for carrying the arch, which resulted eventually in that convex capital which is one of the most prominent characteristics of Byzantine architecture. But the block above the abacus, from which the arch springs, is made a strong point of objection with some of the opponents of this theory, as being a corrupt feature, belonging to a later date than that of Constantine, or anywhere near his time. We will quote in Mr. Fergusson's own words his comment on this part of the question:—

"When in the time of Diocletian, architects first began to tamper with the stereotyped forms of the Roman Corinthian order, they left the cornice and frieze for a long time pretty much as they found them. They pulvinated the frieze, —or, in other words, curved it outwards,—and carved it richly, to supply the place of the figures which were its original and proper ornament, and they omitted some details of the cornice; but the great alteration was made in the architrave. When using arches, as in the Court at Spalatro, they bent the architrave as an archivolt, round the arches, leaving the frieze and cornice as before; but when using a trabeate or horizontal construction, they omitted the architrave altogether, except one block of it over the capital, and afterwards, even in arched construction, used this block in order to give apparent strength to the capital to support the arches, and continued this practice down nearly to the time of Justinian. In his age, however, the convex capitals enabled the architects to dispense with this, their fulness being sufficient to give the requisite appearance of strength. In the intermediate period, however, the architects almost invariably engraved either a cross or a Christian emblem on this *dé*, or cubical block, as in the subjoined example from Thessalonica, dating about the year 500 A.D., and this practice became almost universal in the churches at Ravenna and elsewhere. When the Byzantine style was completed under Justinian, the *dé* was omitted, and the cross or monogram was transferred to the capital, which had then become convex instead of concave, and, in fact, belonged to a totally different style of architecture from that which is found in the buildings of Constantine at Jerusalem."

The small illustration of the Thessalonica arcade we reproduce; but we believe it is not the only instance to be found of a block between the abacus and the arch of this date of the transition from Classic to Byzantine, and that there is more to be learned yet of the details of this singular period of architectural transition. In the mean time, any one who will recall the well-known bulging outline of the capitals of St. Sophia and other specimens of complete Byzantine architecture, must feel at once how impossible, how absurd, it is to imagine that these capitals of the Dome of the Rock were executed *after* the Byzantine form had superseded and obliterated the Classic form, as



Arcade from Church of St. Demetrius at Thessalonica, A.D. 500—520.

according to the popular theory, they must have been. Mr. Fergusson was in great hopes that when the marble slabs which now surmount the capitals of the intermediate range of columns in the Dome of the Rock were removed, and the original *dé* exposed, the Christian symbol would be found in its usual place, and put an end to all question, even among those who cannot read architectural style; but the *dé* turned out to be only a rough block of stone. Mr. Fergusson's explanation, illustrated by the drawing (fig. 1) we have once already referred to, is that the *dé* was originally cased with bronze, as the soffit of the intermediate entablature is still covered with bronze, a supposition which, under these circumstances, seems exceedingly probable.

By those who cannot read architectural "handwriting on the wall" it has been contended that the peculiar employment of the horizontal beam running between the capitals and the arcade, both in the Dome of the Rock and in the El Aksa Mosque, is an indication of their being the work of the same hand following out the same idea. To those who can place any weight on such an argument in the face of the other differences in the two structures it would seem scarcely any use to point out that Aksa merely shows a clumsy imitation by the Mahommedan builder of a feature in the other building which he approved either for constructive or ornamental reasons. The real parallel with this feature in the Dome of the Rock is to be found in the Lateran baptistery at Rome, an unquestionably Constantinian building, where the feature of the continuous beam appears in almost precisely the same form as in the Dome of the Rock. Mr. Fergusson gives, however, another very singular corroboration in a section of a church at Bosrah, extracted from an engraving from the "Syrie Centrale" of his adversary Comte de Vogüé (who is thus made to bear evidence against himself), in which we have the columns with quasi-Corinthian capitals, with a block or *dé* on each abacus, and carrying a horizontal beam or entablature very similar to that in the Dome of the Rock, only that instead of the arcade springing from this entablature, an arch over each inter-column, a large arch is carried over from angle-pier to angle-pier of the octagon, flying over the columns and entablature, the latter being stopped by the jamb of the arch at each end. The Comte de Vogüé himself dates this building, from inscriptions on the walls, at A.D. 512, and Mr. Fergusson regards it as an improved application of the method of design and construction previously carried out in a somewhat less logical form in the Dome of the Rock. We do not think this follows; but there is nothing in the comparative architecture of the two buildings inconsistent with the theory; the architectural scheme at Bosrah is undoubtedly an improvement on that of the Jerusalem building, and undoubtedly it belongs to nearly the same phase in architectural history, and so far is strong evidence on Mr. Fergusson's side: but his argument as to the approximate date of the Jerusalem building appears to us quite inexpugnable even without this assistance from the adversary.

Since the author's theory of the præ-Mahommedan origin of the Dome of the Rock was first promulgated, however, additional light has been thrown upon the matter by the uncovering of the exterior wall of the building. It was known and admitted on all hands that the present external facing and the painted windows were a late Saracenic treatment; but in 1873 the exterior tiling was becoming so dilapidated that a large quantity of it had to be removed, and the original wall disclosed. This proceeding rendered visible, over the principal range of windows, a parapet wall with a range of thirteen small arches on each face, each arch springing from a small shaft with a quasi-Classical base, and a capital bearing a curious resemblance to the simplest form of Norman capital, a block with the lower angles cut away in a curve so as to leave a nearly semicircular plane on each face. This feature is engraved in the proceedings of the Palestine Exploration Fund, and its appearance at once suggests the exterior gallery so often found under the cornice of Romanesque churches in North Italy (especially round the apse). That it is not Saracenic building,—that nothing *like* this is known, at least, in any Saracenic building,—is obvious at once: the strange thing to most readers will be that the capital of the little shafts so much resembles a form that we are accustomed to associate with the eleventh century. Otherwise, the similarity in character between this gallery and that of St. Ambrogio at Milan, with which Mr. Fergusson compares it, is obvious enough. But there are not wanting indications that this supposed peculiarly Norman form of capital had a much earlier and more Eastern origin. The author gives a drawing of one from the "cistern of Philoxenus" at Constantinople, which might pass for an early Norman capital, only that it has not the projecting abacus. But the Christian character, architecturally speaking, of this wall-arcade, as given in the illustration borrowed by the author from the Palestine Exploration Report, is obvious to any one who has even so much as seen drawings of Early Romanesque church architecture.

The whole question of the architectural history of the Dome of the Rock seems likely thus to have a collateral interest for architectural students, in suggesting new ideas as to the date of origin and place of origination of some features of the architecture of the early part of the Christian era; and this is so in regard to one very interesting feature, the pointed arch. For it is one peculiarity of this peculiar building that the arches of the outer arcade, in spite of the pronounced late Classical character of the detail, are very slightly pointed. They can hardly be called, *architecturally*, pointed arches; that is to say, the pointing is so slight that it does not affect one as giving a character to the design, except when seen in very sharp perspective*; and there appears, from the best illustrations we have been able to collate, to be a slight rounding off of the two opposing arcs at the apex, rather than any attempt to make a true point. Still the fact remains that the two sides of the arch are struck from different centres; and this, taken in conjunction with the detail which accompanies them, suggests the question whether further investigation of such remains of this period as are not yet fully exhausted may not reveal other examples of what may be called embryo pointed arches in late Roman buildings, which, like these, will still further emphasise the constructive origin of the pointed arch, exhibiting it in its earliest stage, as an effort to avoid the danger of too flat a crown to the arch without bringing out, more than could be avoided, the appearance of the point as an architectural characteristic.†

Admitting, however, as we believe every one competent to understand the argument from architectural style must eventually admit, that the Dome of the Rock is in its earlier remaining portions a building of pre-Mahommedan date,—and probably of the time of Constantine,—is there equal reason to believe that these portions are the relics of the church built by Constantine? One argument against this is that the sepulchre church is historically recorded to have been

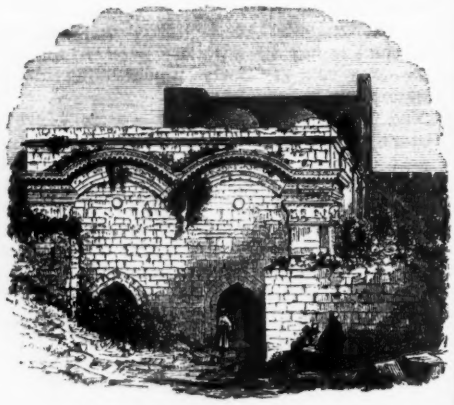
* Good photographs of the interiors,—and they are procurable now,—place the contrast in far more striking light than these small engravings.

* In this respect Mr. Fergusson, in the frontispiece of his former work on "The Ancient Topography of Jerusalem," did an injustice to his own argument in employing an engraving which gave the arches an appearance of very decided point. From comparison with photographs it is obvious that this was a draughtsman's error: the point is so slight that it is hardly perceptible when the arch is seen in elevation.

† While on the subject of the arches, we may call attention to the manner in which the arches of the *inner* arcade are shown in the section of the Dome of the Rock which forms Plate VI. to Mr. Fergusson's work, but which appears to be nearly reproduced from De Vogüé. These arches are shown with a keystone projecting below the soffit of the arch, which is incorrect according to other larger and apparently accurate representations.

twice destroyed, burned to the ground. Mr. Fergusson takes his stand upon the reliability of unconscious architectural evidence as contrasted with the thousand probabilities of error in Mediæval history, with its tendency to exaggeration. As he says, the alternate possessors of the building have involved it in such a mass of contradictory fables that it would be an utterly hopeless task to attempt to unravel its history, "were it not that architecture never lies, and that art, when not purposely falsified, may be depended upon as speaking the truth."* Any one writing of York Minster and its records in the spirit of a Mediæval historian, would, as probably as not, either say or leave the impression that it had been "twice burned to the ground." It would be interesting to ascertain whether any traces of fire are perceptible on the older portions of the Dome of the Rock.

But the probabilities in favour of the Constantine theory are certainly very much enhanced when we take the building in connexion with the smaller structure on the east side of the Haram area, known as the Golden Gateway. It is on record, and is generally believed by all parties, that Constantine erected near the Church of the Resurrection a church (Martyrium) in memory of the site of the Crucifixion, and that he built a sumptuous portal leading to the atrium of this church. Now, the Golden Gateway is such a portal, and its architecture presents the characteristics of the age of Constantine. Some parts of the structure might, indeed, suggest a slightly earlier origin, for it is impossible to look at the curved entablatures in the west front of the structure (the small engraving of which we reproduce from Mr. Fergusson's pages) without at



West Front of Golden Gateway.

once recalling Spalatro. But there is nothing in this feature inconsistent with its being a little later than Spalatro, while on the other hand the style of the capitals of the internal columns, which must have been erected at the same time, is a kind of corrupt Ionic with strong Byzantine tendency,† so peculiar, indeed, that it might be put considerably later if its date were not checked, so to speak, by the external curved entablatures, which retain the principal features of the Classic entablature nearly intact: and again by the entablature and capital over the pilasters in the interior, which also we reproduce. It seems astonishing that Comte de Vogüé and others should have put this building as late as the fifth or sixth century; a theory which the west front alone seems enough to settle. All the indications of its architecture, taken collectively, appear to point to the fourth century. Mr. Fergusson's argument proceeds, that as it is obviously only a gateway to some important building or group of buildings, and that as Constantine did erect such a gateway to such a building, and this is in the style of his day, and we have no other explanation of its origin or meaning, what need to go further? More especially when it is found in proximity to another building of Constantinian date which also answers with great probability to the presumed character of another structure which he is known to have built in the same neighbourhood. It is, of course, obvious that the argument in regard to the two together becomes ten times as strong as it would be in regard to either building taken separately.

If this were Constantine's gateway, then excavation should show some remains of the foundations, at least, of the basilica to which this gateway was one entrance. Mr. Fergusson thinks these have been found in some subterranean walling which was unearthed during the researches of Captain Warren on behalf of the Palestine Exploration Fund, and which he considers to be the foundation of one of the aisle walls of the basilica. The remains are in a parallel line with the axis of the Golden Gateway, but so far north of it as to compel the inference that in that case the gateway was not an entrance right upon the atrium of the basilica, but only to the enclosure which contained it. This removed one difficulty in regard to the statement of Eusebius, that the gateway opened "in front of a broad *agora*," for which the rapid slope of the ground *outside* the Golden Gateway left no possibility, but which Mr. Fergusson now places *inside* the gateway in the space where he would formerly have proposed to place the atrium of the basilica, which he now removes further north to suit the line of Captain Warren's subterranean wall. All this looks perhaps very conjectural, yet there is nothing impossible in it, and certainly the discovery of the wall or foundation was sufficiently *àpropos* to the theory to make it of the greatest interest to get further investigation. This, it seems, has never been done. The discoverer of the wall, who had no interest apparently in Mr. Fergusson's theory, did not follow it up. Mr. Fergusson's note on the subject concludes:—

"When I found he had come away without any further attempt at exploration, I,—fearing that expense might be the cause of nothing further being done,—wrote to the 'Fund' through Major Wilson, offering them, or any one, one hundred guineas if they would only sink a hole where I had marked it on plan, Plate V., and ascertain whether the apse was there or not. I am afraid, however, the opportunity is now lost. In the present state of feeling between Christian and Mahommedan it is scarcely likely any digging there will be allowed, and we must, therefore, be content with the very meagre particulars we now possess."

Unless there is some further explanation forthcoming, we must say that the neglect of such a request from such a quarter was, to say the least, very much to be regretted. We do not see enough evidence yet to prove that this was the site of the Basilica, or that the Golden Gateway was the entrance to it; but there cannot be a question that the theory has sufficient interest and consistency to be well worth a little trouble in testing it further; and if the apse were discovered, in the position indicated by Mr. Fergusson, or ever so small an unquestionable relic of it, the whole chain of evidence would be complete, and the theory irrefutable.

As to the question whether this could have been the real site of the Crucifixion and the entombment, we do not consider, as we have before said, that the actual correctness of the site is, as a matter of course, involved in the question whether these were Constantine's buildings. It is not to be taken for granted that Constantine himself was correct about the site, though on the whole the probabilities are as much in favour of his having correct information or tradition as not. As to the probability of the site *per se*, it is at least more answerable to the Bible narrative than that of the Church of the Holy Sepulchre. The strongest of the objections urged against it is the improbability of the position of such a locality as Golgotha, with the grisly relics and associations implied in the name, being found just outside the walls of the temple. This, no doubt, has much more force with those who believe that the temple enclosure occupied the greater part of the Haram area than it would have on the topographical system of Mr. Fergusson, whose restoration of the temple only covers the south-west portion of the area. Indeed, he uses the proximity of the temple and of the Tower of Antonia to the place of crucifixion, which his theory presupposes, to offer what is unquestionably an exceedingly ingenious interpretation of one or two facts in the narrative as given in St. Matthew's Gospel. The soldiers who "mocked" were, he suggests, not the regular guard who might be detached to see the execution properly carried out, but the idle soldiers of the garrison which was quartered in the neighbouring Tower of Antonia; and the "vinegar" was that which, when mixed with water, was the ordinary drink of the Roman soldiers, which a soldier "ran" and brought from the adjoining quarters. The other suggestion we give in the author's own words:—

"We gather the same impression from the conduct of the priests and people throughout all these transactions. They went together to the Roman governor to clamour for his execution, but there is no hint that any of the priests accompanied him to the place of execution. He was followed there by a great crowd of people (πόλυ πλῆθος τοῦ λαοῦ), but the priests apparently kept apart, and 'mocking him, with the scribes and elders, said, "He saved others, himself he cannot save."' Where, then, were these priests? The answer seems easy: they were looking on, *from the roof of the northern cloister of the Temple*. There, at least, they could easily see all that passed," &c.

This is very real, and shows that the author has some of the qualities that would have made him a good historian of other things besides architecture.

For reasons aforesaid, however, we rather decline to accept at this moment anything decidedly as to the precise site of the events connected with the Crucifixion. Our interest is with the question of architectural history which Mr. Fergusson has raised and illustrated in so brilliant and persevering a manner, and which not only seems to offer a probable solution, of a very interesting kind, of the origin of two remarkable structures which are hitherto entirely unexplained, but also raises collateral questions in regard to the transition from Classic to what may be called Christian architecture, which may suggest a good deal to future architectural students. At some other time we may endeavour to follow out the theory as to the plans of the various Jewish temples, with which the bulk of this very full and valuable book is occupied; but we feel a more immediate interest in the portion we have dealt with above, because it is based on structures which are actually in existence, and has a more direct and practical bearing on the study of architectural history.

* It is unnecessary to point out to our readers that these remarks refer to the ancient and Pre-Renaissance architectural styles. But so ill-informed are some of the most prominent Jerusalem topographers on this subject, that they have actually imagined it was a sufficient answer to Mr. Fergusson's theory to say that the Saracenic architects of the Dome of the Rock were only imitating Classic architecture, just as modern English architects imitate thirteenth-century architecture: apparently quite unaware that this imitative architecture has only existed in the modern period since the invention of printing and the revival of literature.

† It is remarkable here, again, how we find in a portion of these capitals a channelled or scolloped ornament remarkably similar to a well-known favourite decoration of Norman capitals.

THE TYNEMOUTH AQUARIUM, WINTER GARDEN, AND BATHS.

THE Tynemouth Aquarium is about to be opened. Although for many years Tynemouth may have claimed to be considered a watering-place, yet she has been such only in a very limited way. No attention has been given to the need of improvement, little attempt made to take advantage of her natural attractions, and the accommodation hitherto supplied to visitors has been insufficient.

On Tynemouth Links a group of buildings is being completed, consisting of an aquarium and winter garden, baths, club establishment, skating-rink, and pleasure-grounds. The style of architecture adopted is the Italian Renaissance, and the buildings extend from the upper level of the Cullercoats-road to the sea-shore. The length of the main façade is 336 ft. On either side the grounds will be planted with pines, tamarisks, and other hardy trees and shrubs, and meandering paths traversing the slope will communicate between the different levels.

Entered from the road between Tynemouth and Cullercoats will be situated the winter garden or floral hall. This edifice is 225 ft. long by 60 ft. broad, with a mid-transept, increasing the width in that part to 72 ft. The sides consist of a light and lofty arcade of stone, and are filled in with glass. The roof is vault-shaped, of glass, on wrought-iron ribs and principals. The general appearance will be diversified by groups of statuary and fountains. Outside, facing the sea, is the upper of a series of terraces, the balustrades of which will bear vases of flowers.

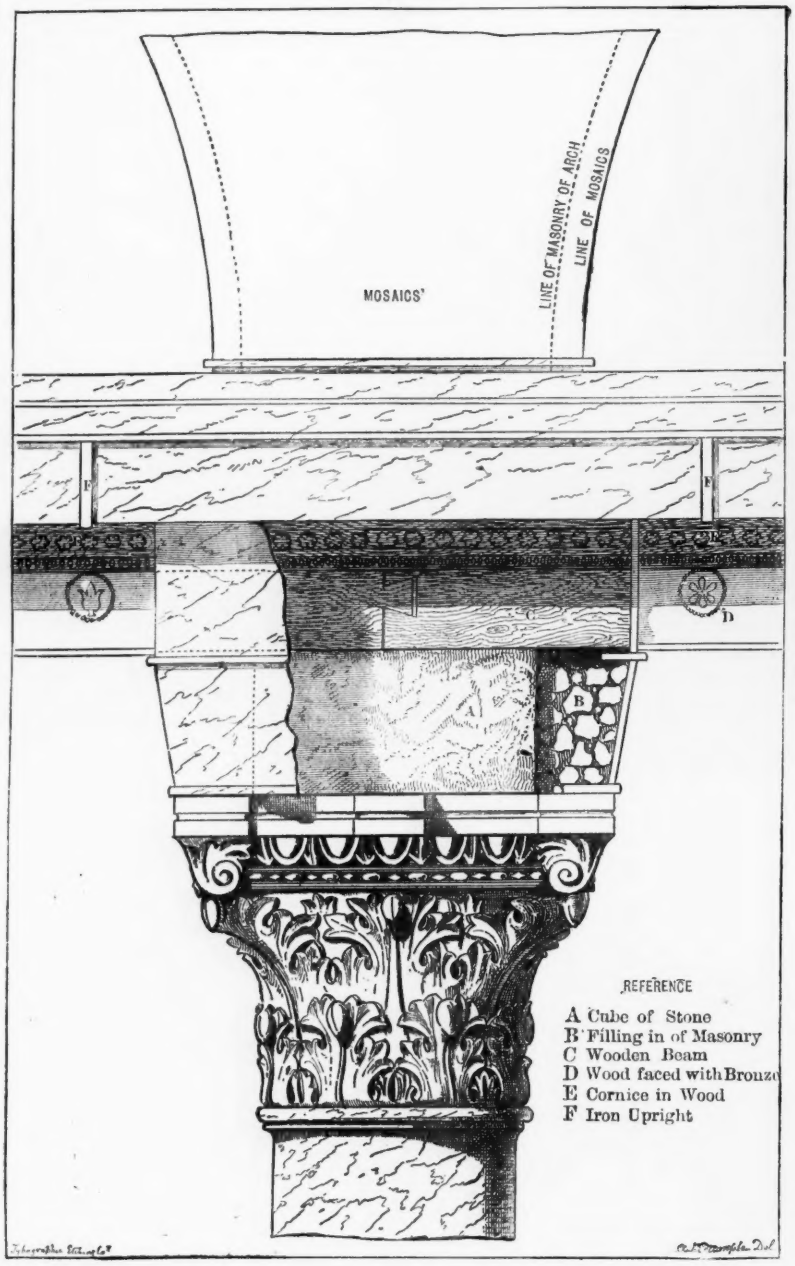
At each end of the winter garden are the entrance-halls. Above, on the first floor, are the library and reading-rooms, the secretary's and manager's rooms. On the second floor are card, billiard, and smoking rooms. On the third floor, the bedrooms of the domestics.

The aquarium includes both salt and fresh water tanks, occupying both sides of the hall. A row of columns divides the floor into two avenues.

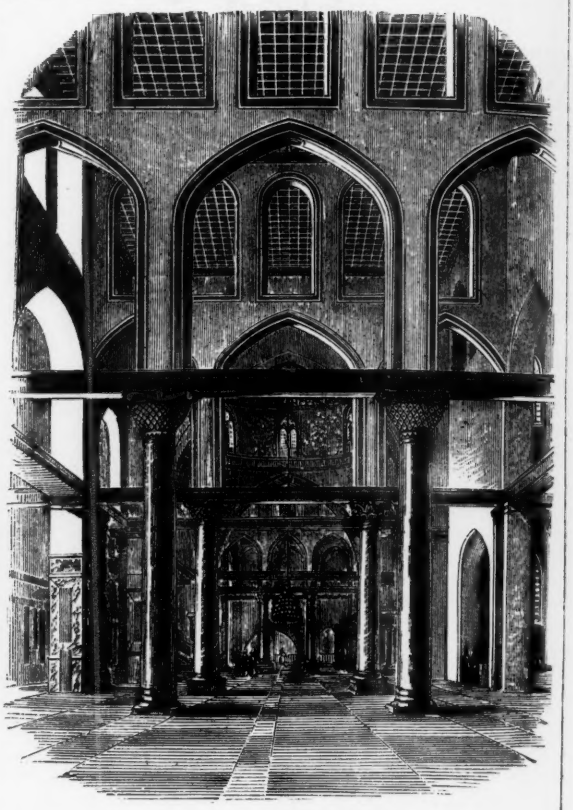
The baths, at the bottom, are not yet commenced. The sum of 50,000*l.* has been already spent, and 30,000*l.* more will be required to complete the design. The architects are Messrs. John Norton and P. E. Masey, of London.

The Artisans' Institute.—A *soirée*, to celebrate the conclusion of the fourth session, is to be held in the Hall on Monday, June 3rd, when Lord Lyttelton will take the chair.

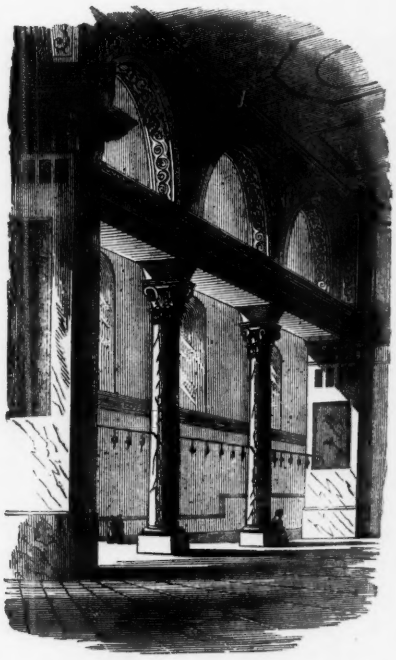
ILLUSTRATIONS OF BUILDINGS IN THE HARAM AREA AT JERUSALEM.



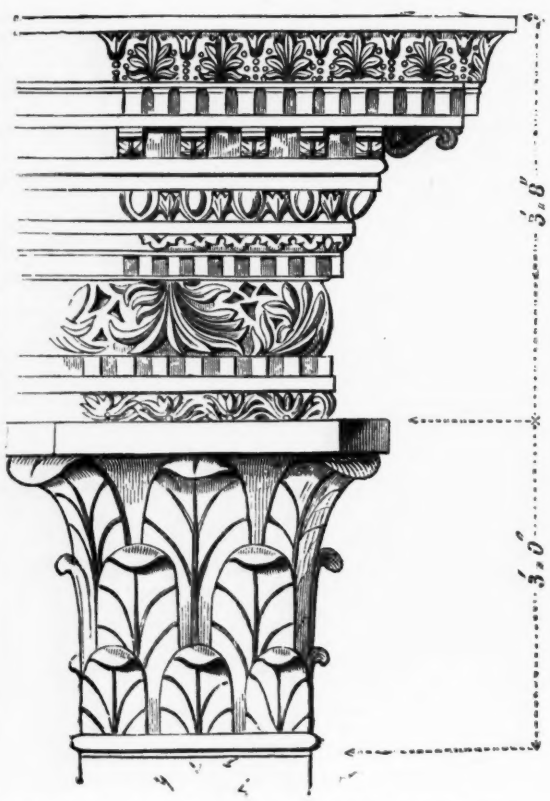
1. *Capital and Entablature of intermediate Range of Pillars in Dome of the Rock.*



2. *View in Mosque El Aksa.*



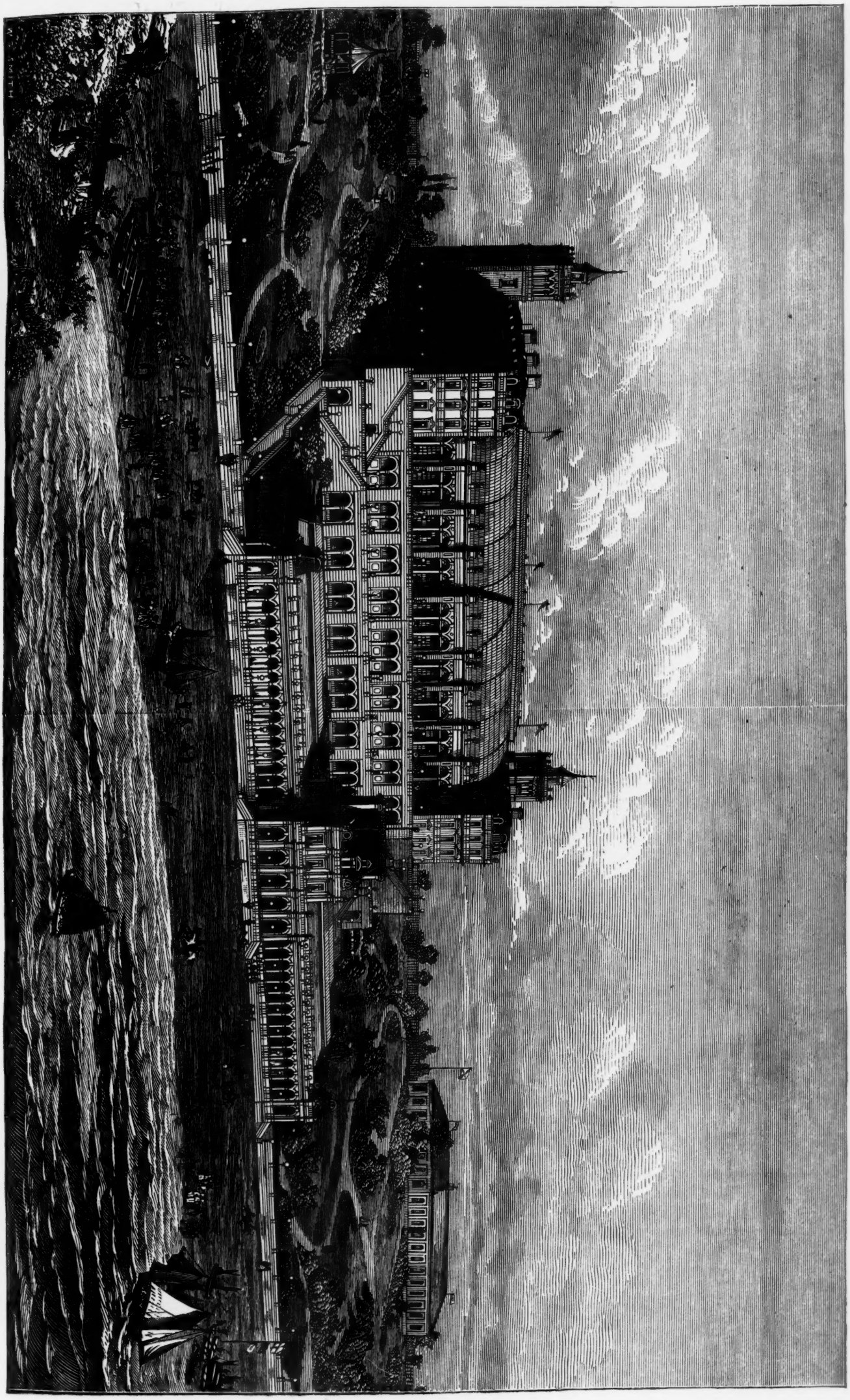
3. *View in Dome of the Rock.*



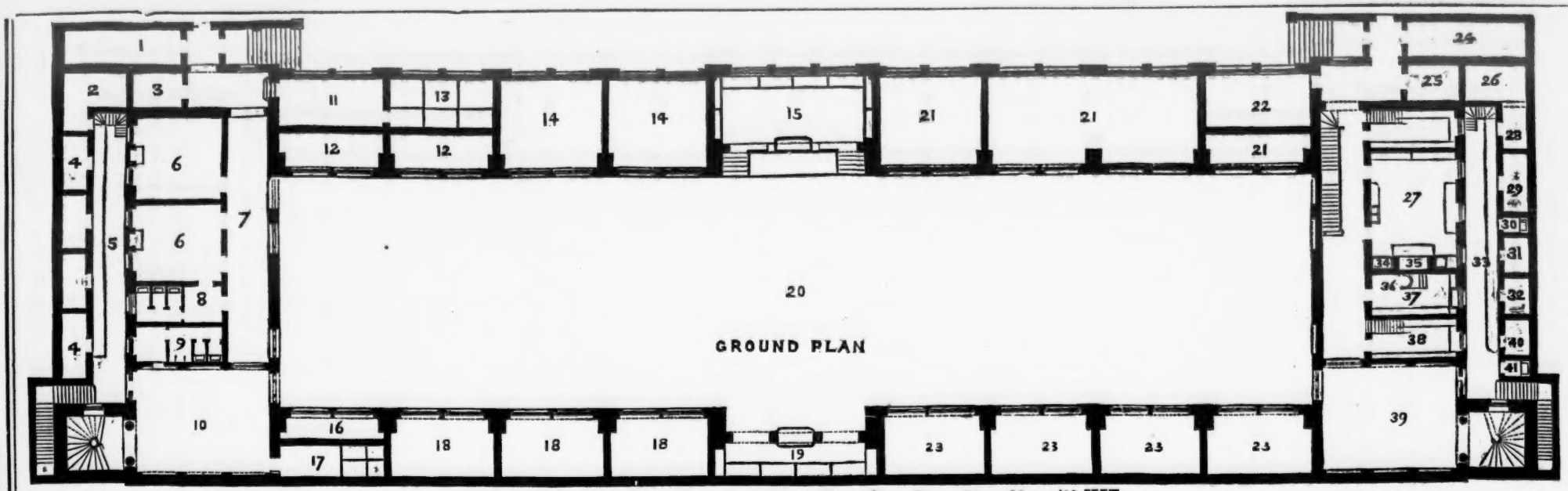
6. *Capital and Entablature in Interior of Golden Gateway.*

4. *Capital in Dome of the Rock.*

5. *Capital in Mosque El Aksa.*



THE TYNEMOUTH AQUARIUM, WINTER GARDEN, AND BATHS.—MESSRS. JOHN NORTON AND P. E. MASEY, ARCHITECTS.



1. Beer-cellar.
2. Coal-cellar.
3. Wine-cellar.
4. Cellars.
5. Area.
6. Refreshment-room.
7. North Corridor.
8. Ladies.
9. Gentlemen.
10. Lower Hall (North).
11. Naturalist.
12. Fresh-water Tank.
13. Reserve Tank.
14. Fresh-water Tank.
15. Table Tanks—Fresh-water.
16. Zoophites.
17. Attendants and Reserve Tanks.
18. Salt-water Tank.
19. Table Tanks.
20. Aquarium.
21. Salt-water Tank.
22. Engine-room.
23. Salt-water Tank.
24. Beer-cellar.
25. Wine-cellar.
26. Coal-cellar.
27. Kitchen.
28. Coal-cellar.
29. Larder.
30. Men's W.C.
31. Larder.
32. Store.
33. Area.
34. Oven.
35. Close Range.
36. Boiler.
37. Scullery (Room over).
38. Pantry (Room over).
39. Lower Hall, South.
40. Cellar.
41. Maids' W.C.
42. Area.
43. Hall for Music, 53 ft. by 28 ft.
44. North Entrance-hall, 28 ft. by 23 ft.
45. Grand Winter Garden and Promenade, 216 ft. by 50 ft.
46. Upper Terrace.
47. Middle Terrace.
48. Refreshment-room, 34 ft. by 18 ft.
49. Ladies' Lavatory.
50. Area.
51. Gentlemen's Lavatory.
52. South Entrance-hall, 28 ft. by 23 ft.
53. Door.

THE TYNEMOUTH AQUARIUM AND WINTER GARDEN.

DISTRICT SURVEYORS AND DANGEROUS STRUCTURES.

SIR,—I enclose copy of letter I have recently sent to every member of the Metropolitan Board of Works, and shall be pleased if you can kindly insert the same in your next issue.

It is past endurance that educated members of an honourable profession should attend police courts for day labourer's wages.

ROBERT WALKER.

My name having been prominently before the Board, with reference to the late accident in the Haymarket, and it being evident from the remarks that were then made that considerable misconception exists as to the duties and responsibilities, as well as emoluments, of district surveyors, I beg respectfully to solicit your careful perusal of the following statement of facts with reference to my district.

When I was appointed district surveyor to the parishes of St. Martin-in-the-Fields and St. Anne, Soho, in January, 1875, I soon found that though the duties were very onerous, and the responsibllity great, yet that the income to be derived from the appointment was practically nothing.

This results from the following causes:—Both parishes are entirely covered with houses (with the exception of the strips of vacant land on the Northumberland-avenue) and a large number of buildings in St. Martin's parish are Government property, and exempt from the Building Act.

The principal matters, therefore, that come under the cognisance of the district surveyor are dangerous structures, and making surveys and reports, and attending Police courts, to give evidence with reference to them. There are a large number of these, especially in the parish of Soho.

It happens, however, that the fees allowed for this class of work are not only totally unremunerative, but practically in many cases do not even pay the expenses out of pocket.

The scale of payment is as follows:—

For surveying and reporting on a dangerous structure not exceeding five squares and two stories	£0	7	6
Exceeding five squares	0	10	0
Every additional story	0	2	6
For attending summons, and giving evidence at police-court	0	5	0
Attending on adjourned summons and giving evidence	0	2	6
During the past year the total receipts from all sources in my district were	207	5	9
Expenditure:—			
Rent of office, clerk's time making up and collecting returns, stationery, postage, cost of books and forms, expenses of ladders and men plumbing dangerous structures, &c.	140	0	0
Net income	£67	5	9

The Building Act and Regulations of the Board compel the district surveyor to keep an office open within his district, and a competent clerk always in attendance, between the hours of ten and four, and as the net income of 67*l.* is to a large extent made up of payments of small fees for dangerous structure surveys, and attendances at police-courts, the travelling expenses and loss of time connected with these practically much more than swallowed up the whole income.

As regards dangerous structures, they occur so frequently, and often unexpectedly, that I have been sometimes called up twice in the middle of the night by police telegrams within one week, informing me that walls had fallen, and requesting me to come at once and superintend the shoring of adjacent property. In the day time, this is a common occurrence. As the district surveyor has no power of entry into buildings to ascertain if they are dangerous, it is impossible to foresee when any structure may be found to be in that condition, and it is therefore essential that a competent clerk should be all day at the office to attend to any dangerous structure notices that may be received. The anxiety as well as trouble, and waste of time, caused by these dangerous structures, is such that none but those who have to deal with them can have any correct idea on the subject. I have often been compelled to attend at police-courts on adjourned summonses, and after waiting for some two hours for the case to come on, and then giving important evidence affecting the safety of life and property, have received for my trouble the handsome fee of 2s. 6d.

A dangerous structure notice usually involves the following:—A survey and report to the Board, and generally two or three inspections, to see whether the property is properly shored, and often the expenses of sending men to plumb the premises before reporting, writing the Board with reference to the shoring, and giving sketch and instructions what shores are to be fixed, measuring up the contractor's shoring, and checking and certifying his account, and attending the police-court, and giving evidence, sometimes two, three, or even more times, and often waiting until the case comes on, generally writing to the owners two or three times, or seeing them when they call at the office, and very often seeing the surveyors to both leaseholders and freeholders, and writing answers to their letters, the average fee for all the above work being seldom over 1*l.*, often less, and I have frequently in these cases spent more in cab-hire when summoned in the middle of the night, and for cost of plumbing the premises, than the whole fee allowed by the Board.

As the greater part of the works in my district consists of these dangerous structures, this part of my duty is not only totally unremunerative, but practically a serious money loss, apart from the responsibility attached to it. As a specimen, I may mention that some time ago I reported on the safety of Drury Lane Theatre, after about 150 ft. of external stone cornice had fallen suddenly in the middle of the night; and that though I was four hours carefully inspecting the whole fabric, and compelled the owners to spend a large amount of money to render it safe, and met the architects to both the lessees and sub-lessees several times, and attended on five separate occasions at the building, as well as directed the erection of the shoring, and checked the contractor's account, yet the only fee I received for all this was 1*l.* 7*s.* 6*d.* I have lately had a still more serious case at the *Echo* printing office, Strand.

The small fees charged the public for these services are practically a direct encouragement to recklessness, and a premium or them to allow their buildings to fall nto a ruinous condition. The remark is constantly made to me, when I remonstrate with owners on the wickedness and folly of allowing walls, and especially foundations to piers, to fall into a condition dangerous to the inmates of their houses, that they find it cheaper to wait till the district surveyor comes with the order of the Board to survey them, as his services practically cost them nothing, whereas an architect would charge three to five guineas for a report on their buildings.

The Building Act, section 69, says that the district surveyor shall report to the Board any information he may receive with regard to dangerous structures; but the general idea in the public mind, I find, is that the district surveyor is a kind of guardian angel of building structures, watching over the whole of his parish, who, in the language of one of the jury at the late inquest, should make every one safe (even when, by their own folly, the owners allow their buildings to fall into decay), and though the district surveyor has no legal power to enter them.

I have recently had under my notice two singular instances of the extent to which this impression pervades all classes.

I condemned part of an old house in Greek-street, Soho, as dangerous. The fee for this would be about 15s. I received, shortly afterwards, a notice of commencement of works, from Mr. Whiteley, of Westbourne-grove (who has recently added to his other vocations that of practical builder), and a request that I would instruct his foreman how much of the old building to take down, and what to do to make it safe; in fact, for the above sum, to act as consulting architect to a building where no surveyor was employed.

The same week the proprietor of the *Echo* newspaper sent word to the Metropolitan Board of Works that his own printing-office was dangerous, and upon my inspecting the premises, he informed me he considered it my duty to tell him what to do to make his building safe; of course, I could merely condemn it, and he has since found it necessary, from the extremely dangerous condition into which it had fallen, to call in the services of two eminent architects to advise him.

As regards new buildings, my case is even still more singular; there are very few new buildings erected in the district; last year there were only five, but they are generally very large structures requiring great care and judgment in their erection, and principally supported by scientific iron construction. The Building Act specifies that no fee for a new building shall exceed 10*l.*; there are two buildings now erecting in my district, the cost of each of which is over 80,000*l.*, so that practically I receive for superintending these works the sum of 2s. 6d. per 1,000*l.* worth of work done. A broker would charge ten times this sum for merely transferring the same amount of Bank Stock. The absurdity of the remuneration is, however, better shown by the fact, that if the outlay on these buildings was in the suburbs it would probably represent about 200 houses, the fees on which would be about 600*l.*, yet practically, the responsibility, trouble, and anxiety in overlooking the large buildings I speak of is really much greater than it would be with regard to the 200 ordinary houses. An assistant could render great help in the latter case, but with respect to the former the district surveyor must do all the work himself, so that the fact remains that for the sum of 3d. per cent. the district surveyor is assumed to a great extent to be responsible in these cases for any blunders of construction, or in the execution of the work, and also all scamping alike of workmen, foremen, and contractors; while he has always hanging over him the contingency of a verdict of manslaughter from an ignorant coroner's jury, with the chance of spending a night in a common gaol. This fate, I understand, I only escaped at the late inquest because two of the jury, having somewhat clearer views than their fellows, compromised the matter by blaming me for allowing other people to do what I had no legal power to prevent, while they passed no opinion whatever on the actual authors of the failure. . . . . .

As an architect, I can, I believe, confidently refer to the numerous buildings already erected under my superintendence in testimony of my professional character and ability; and I wish to submit most respectfully to the consideration of the Board the following facts, founded on my experience as a district surveyor:—

1st. That no district, so small as mine especially, where the duties consist almost entirely of condemning dangerous structures, can be profitably or properly worked, even though the outlay be more than the receipts. The only really efficient way to work a district is for the district surveyor to make a point of seeing every building or alteration himself, both at its commencement and close; but it is also essential that he should have a competent assistant, who should make it his duty to call at the buildings frequently, and when not expected, in order to detect irregularities and report same to his chief. It is impossible for any district surveyor to do all this himself, nor is it, for many reasons, desirable he should always be his own detective. At a low computation, for even a small district to be managed on this plan, the office expenses cannot be less than 200*l.*

2nd. I also respectfully submit, that the present fees for dangerous structure surveys, and attendance at police-courts, superintending shoring, &c., are most unfair to district surveyors.

3rd. That a fee of 2s. 6d. per thousand pounds outlay, or 3d. per cent., is not enough remuneration for surveying large blocks of buildings, and taking the heavy responsibilities connected with them.

4th. That district surveyors should have the power to compel drawings of new buildings to be submitted to them, and also the right to enter at proper times old houses, to see if they are dangerous.

5th. I would most earnestly join in the wish expressed by one of the members of your Board, that the duties of district surveyors should be more clearly defined; and the public properly informed what those duties are.

I also wish to express to the Board my apprehension, that at any moment a serious catastrophe may happen in my district, accompanied by great loss of life which I am powerless to prevent. A large number of the houses in Soho parish are old mansions of a past era, which, from age and neglect, are in an exceedingly ruinous state; many of them are owned by freeholders who have not seen them for years, and let to tenants at high rentals, who sublet the separate apartments to a low class of foreign prostitutes. From the neglected condition of the property, its ruinous state, and the dissipated and nocturnal habits of the inmates, several accidents have already occurred, and I fully anticipate being called up some night by a police telegram informing me that one of these houses has fallen and killed its inmates. I wish to state these facts, in order that the Board may be prepared for such an occurrence which I deem highly probable. In order, however, to prevent it as far as possible, I have made arrangements to survey systematically, and as far as I have the power, the whole of the houses in this parish, and to report to the Board every dangerous structure I can detect. This is, really, no part of my duty; it will, I know, cause great hardship and suffering to many innocent persons, and must, as far as I am concerned, be simply a labour of love, as the fees will not pay even the expenses in the matter.

There is also another irksome duty which takes up a large portion of a district surveyor's time in my case, and for which no fees whatever are allowed. Scarcely a week passes but some foreign restaurant-keeper or other in the streets adjacent to Leicester-square, is found to be breaking the law by erecting projections beyond the line of frontage or carrying up some wooden buildings, contrary to the Building Act, and I may state that nearly every street in my district has several of these irregular structures in it, the result of many years of past neglect; a large portion of my assistant's time, and often my own, is occupied in threatening police proceedings against these intelligent foreigners, and losing both time and patience in trying to enforce and make the law understood, whereas should one of them escape notice, the usual formula is directly applied:—Where is the district surveyor? I would again respectfully submit that it is not fair for a district surveyor to be compelled to act the part of a gratuitous public prosecutor.

ROBERT WALKER,
District Surveyor of St. Martin's-in-the-Fields, and St. Anne's, Soho.

CONGRESS ON NATIONAL WATER SUPPLY.

SOCIETY OF ARTS.

IN continuation of our report * of this Congress, we will, before proceeding with our notes of the second day's sitting of the Conference, refer to a few points which, for want of time and space, were omitted from our account of the first day's proceedings.

Dr. Wright, medical officer of health for Cheltenham, spoke of the increasing difficulties experienced by rural districts in obtaining adequate water supplies.

Mr. Williams, of Liverpool, advocated that the Government should take under control the mountain streams of Scotland and Wales, and the lakes of Cumberland, and contended that, by judicious engineering works, the waters of those localities might be impounded and distributed to the large towns of the country at a comparatively trifling cost, the interest on which might, he suggested, be met by an income-tax of a penny in the pound.

Dr. Bond, of Gloucester, criticised some of the provisions of the Public Health Act Amendment Bill (which has just passed its second reading in the House of Lords). Dr. Bond said that the provisions contained in that Bill as to the water supply of cottages would prove, to a large extent, inoperative, as the tenement owners and occupiers were frequently too poor to defray the cost of laying on the water. The only way in which such difficulties could be got over would be by the imposition of "Private Improvement Rates," extending over a period of three or four years, and payable by the owners and occupiers. No legislation would be effective which trusted to the enthusiasm of rural sanitary authorities. For the purpose of effecting the necessary works required for the water supply of rural districts, he urged that rural sanitary authorities should be empowered to borrow money of the Public Works Loan Commissioners.

Dr. Syson said that little progress would be made in providing the rural districts with good water so long as there were divided counsels at the Local Government Board. As to what was and what was not good potable water the chemists and engineers of the Board were constantly at loggerheads. Whatever steps might be necessary to secure better water-supply for the nation at large, care should be taken not to place additional power in the hands of the Local Government Board, the official department of which was, in its organisation and method of working, so utterly and so persistently wrong that it was the laughing-stock of all who knew anything of the requirements of local administration. The whole system upon which its business was conducted was rotten, and it stank in the nostrils of the country. Only when the Augean stable at Whitehall was cleansed would there be much hope of sanitary progress in the country. As to the powers conferred by legislation on sanitary inspectors or inspectors of nuisances with regard to the quality of water, such officials were, as a rule, totally unfitted to exercise discretionary powers, seeing that the powers with which they were invested required some knowledge of science.

Mr. J. F. Bateman, F.R.S., contributed a short paper in which he said:—

"No one is more convinced than I am of the evils arising from a bad or deficient supply of water, nor can any one appreciate more highly than I do the excellent motives

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* See p. 534, *ante*.

which dictated the Prince's letter; but I see no way in which a large and comprehensive scheme of a national character could be made subservient to the objects his Royal Highness has in view.

How, for instance, could any scheme be combined for meeting, at the same time, the wants of a village in Northumberland and one in Cornwall, or a village in Essex and another in Merionethshire?

The large cities and towns provide for themselves and their neighbours, but many small isolated villages lie beyond the reach of such places or the aqueducts which supply them. These small places cannot afford to incur any great expense, and as, in this commercial country, few people will be found to lay out their money on unremunerative undertakings, the only way of meeting the wants of such small places will be by the aid or contributions of philanthropic persons, who will give their money without hope of return, for the benefit of those who cannot help themselves.

Much may be done in particular districts by the adoption of such conditions as have been imposed on the Manchester Corporation to supply, within certain limits, all urban and rural authorities who may demand water which lie in the neighbourhood of the aqueduct from Thirlmere to Manchester, but such arrangements would not benefit distant places."

Mr. Martin Underwood said that the Congress seemed to be rather too prone to discuss the question of potable water only; but it should not be forgotten that the husbanding of natural resources in the shape of water supply was needed for the land and for the rivers themselves. In communications to the *Builder*, he had pointed out, years ago, that while we had vastly improved our land for agricultural purposes by underdraining, one effect of such improvement had been to cause the rainfall of the conntry to pass very rapidly into the watercourses, whence it was carried rapidly away, doing much damage by flooding the low lands, and resulting in drought when the water was most wanted. In order to store the abundance of water which we might make available, he had suggested a complete system of storage reservoirs in each watershed area. The water-closet system was a great enemy to water conservators, not merely on account of the waste of water which it engendered, but because of the pollution caused not only by sewage matter, but by lead from the soil-pipes. The gradual wearing away of soil-pipes was well known. He had calculated that 600,000 lb. of lead were carried into the sewage of London from this cause every year, and as, according to Professor Wanklyn, one-tenth of a grain of lead would poison a gallon of water, 600,000 lb. would poison a lake twenty-one miles and a half square and 10 ft. deep.

Mr. Joseph Whitley said that the provision of storage reservoirs was a simple matter of engineering skill. The abundant natural supplies of water must be reserved at the first point, in order to secure purity, and distributed throughout the length and breadth of the land by conduits. This mode of distribution could be effected to a large extent by gravitation, while the power of the wind and tides could be largely used for pumping purposes, doing perhaps four-fifths of the labour required to be done.

The Chairman (Sir Henry Cole) said that a valuable paper by Mr. W. H. Wheeler, bearing on the points referred to by the last speaker, appeared in the last number of the Royal Agricultural Society's *Journal*.

At the second day's sitting of the Conference, the chief topic discussed was the water-supply of the metropolis. Sir Henry Cole, who again presided, suggested that it would be advisable to discuss this question as far as possible from a scientific point of view, as any reference to cost, and compensations to existing interests, would tend to needlessly complicate the question, which was as to the best way of providing an unlimited supply of pure water for London.

Professor Frankland was the first speaker. He said that there were few river basins which contained such good water as that of the Thames, and London might fairly lay claim to the lion's share of it. In a long drought the Thames was supplied exclusively from springs, and in the greatest drought 350 million gallons passed over Teddington Lock every day, after the abstraction of from 40 to 50 million gallons by the water companies. Then there was a great deal that came into the Thames below Teddington. After being for a long time opposed to the idea, he had at last come to the conclusion that it was desirable to have two systems of water supply in London. To supply such an immense quantity of good water to be used mainly for flushing services was to commit great waste. He did not, however, favour the notion of having two kinds of water in the house, which he thought would be a dangerous thing, for the servants would be sure to go to the nearest tap, whatever the quality might be. Therefore, he would not introduce into the house more than one supply, but he would have an indoor supply and an outdoor supply. The domestic supply for London amounted to 97 millions of gallons a day, and for trade and all other purposes only 20 millions, but he believed there was enormous waste of the water supplied in private houses. He would have the sewers flushed by the outdoor supply, and done under the control of the sanitary authorities, and in order to prevent the waste in houses he would have the water charged for by meter. Instead of a supply of something like thirty gallons per head a day, he thought ten gallons were sufficient. The experiment had been tried in Malvern, and it was found that seven gallons and a half a day for each person sufficed. By this means they would greatly diminish the difficulty of supplying large towns with pure and wholesome water. For instance, the water at London Bridge, if it were allowed a day or two to settle, would be good enough for ordinary purposes other than dietetic.

The Chairman asked whether the Professor would say the same thing of water taken at Crossness.

Professor Frankland replied that he would not say that, and he would not say that a spring-tide might not bring back some of the sewage to London Bridge, but with ordinary tides the water at London Bridge was little worse than that at Teddington Lock. He had gone carefully through the records of the investigations made by Mr. Bramwell, Mr. Easton, and others, on the necessity of high-pressure for the extinction of fires, and there could be no doubt the result of their investigations was that it was absolutely necessary for London to have a separate and special supply of water for the extinction of fires, or, at all events, there must be a new supply brought into London for that purpose. He differed from the engineers of the Metropolitan Board of Works, inasmuch as he would use the new system of mains for the outdoor or high-pressure supply, and the existing system of mains and pipes for the indoor supply. It was important to bear in mind that it had been ascertained that within certain limits hard water and soft water were equally wholesome.

Admiral Sir Erasmus Ommanney referred to the fact that, at the instance of the Thames Conservancy, many of the towns on the upper Thames had diverted their sewage, and asked whether any great difference was appreciable in the quality of the water.

Professor Frankland was unable to say with precision, as there were no regular analyses made; but, as far as his experience went, there had not been very much improvement in the water of the upper Thames since that part of the river was placed under the jurisdiction of the Thames Conservancy in 1866.

In reply to a question put by Mr. Chadwick,

Professor Frankland said, he did not think that Thames water, as taken from Hampton and filtered, could by any appliances be made sufficiently pure and wholesome for dietetic purposes. What he meant by the pure water of the Thames basin was the water of the springs and deep wells, with which there was no mixture of sewage.

Mr. Williams, of Liverpool, contended that, instead of the supply of water per head to the inhabitants of London being reduced, as proposed by Professor Frankland, what London needed, and what the whole country needed, was an increased supply. It was all very well to say that the water was wasted in driblets, which were ineffectual for flushing closets and drains; but it was important to remember that the constant renewal of water in traps was a prime necessary of wholesome houses, for the water was soon contaminated by the sewer gas, and when so contaminated it readily allowed of the passage of the gas through it. If the Professor's advice were taken, London might expect an increased death-rate.

Mr. Joseph Lucas, F.G.S., speaking of the supply of water likely to be yielded from the chalk, said that if the water were taken from the chalk in the districts proposed by the Metropolitan Board of Works, the effect would be to cause a depression of the water-line in the several localities. At the same time, it was possible that a great deal of the chalk which did not at present hold water could be made to hold it by artificial means.

Mr. Edwin Chadwick, C.B., agreed with Professor Frankland that the water-supply of London would well bear diminishing. It was monstrous to suppose that anything like thirty gallons per head per day (or say fifteen pailfuls) could be needed for domestic supply. The present system was extremely wasteful, and in his opinion the possibility of the beneficial reduction of the London water-supply per head was undoubted.

Mr. Towle, of Oxford, referred to the costly intercepting sewerage works undertaken at Reading and Oxford, and contended that the Thames would be very little, if any, the better for them, seeing that the sewage was passed on to land near the river, and would enter the river without being purified.

Mr. Murphy, of Liverpool, in reference to Professor Frankland's advocacy of the system of charging for water by meter, asked how the adoption of that system would prevent waste in the case of cottage and small tenement property, where the landlord paid the water-rates? Meter or no meter, some of the tenants would not be careful to avoid waste unless they themselves paid for the water.

Mr. S. C. Homersham, C.E., read a paper, in which he said,—

"Earnest men, who pursue science for its own sake, and experts who have made themselves specially acquainted with the qualities which characterise water best fitted for domestic use, would agree,—

1. That such water should be wholesome, free from animalcules or other organisms, animal or vegetable, either living or dead, and at no time or season of the year, or in periods of epidemics, liable to propagate disease or cause the death of those who drink it, or who use it to dilute milk or to mix with other beverages.

2. That it should be soft and pleasant to use with soap both for washing the person and clothes, for baths, and other detergent purposes, and of a quality such as would not dissolve lead, or form a deposit or fur when boiled.

3. That it should be clear and bright, and agreeable to the eye, and refreshing to the taste.

4. That it should be well aërated, of a useful uniform normal temperature, and not, like river or surface water, unduly warm in summer or unduly cold in winter, and so, as in the latter case, liable to be readily frozen in the distributing and service pipes.

It unfortunately happens that many considerable portions of the metropolis and the suburban and country districts around it, are still supplied with water in every respect of a quality at variance with the before-named characteristics; while other portions of the metropolis are supplied with water at variance in essential respects with some of these characteristics, and this notwithstanding that powerful and costly efforts have been made, by disinterested and able scientific men and others, during the last quarter of a century or longer, to prevent the use of the worst of the present sources, and to cause the metropolis to be supplied with uncontaminated, wholesome, and soft water, possessing all the characteristics hereinbefore named.

Probably, there is not to be found another large city in the whole world more admirably situated, as respects both the geological formation and the physical features of the country around it, than this great metropolis for the ready construction of works at a moderate cost capable of affording an abundant and adequate supply of wholesome soft water, well fitted for all domestic purposes, as well as for the construction of covered service reservoirs situated far above the tops of the highest houses built even on the most elevated ground, for keeping the pipes constantly charged, and to convey the water into consumers' dwellings.

But, while the physical difficulties of constructing works to afford an adequate supply of such suitable water, distributed on the most improved system, and the financial difficulties attending the obtaining the requisite amount of money to construct the works, are small indeed, yet, mainly owing to the want of knowledge connected with water-supply, not only among the great mass of the inhabitants, but among men unusually intelligent and well informed on other matters, many portions of the metropolis are still kept wholly supplied with, and the inhabitants have no choice but to use, water from the River Thames, not only of a very inferior quality, but such as in hot weather is likely, and from past experience we may say is sure, sooner or later, in seasons of epidemic, to propagate disease and illness, and to cause premature death among many of those who drink it."

Mr. Homersham went on to say that within a convenient distance northward of London there were more than 1,200 square miles, and southward more than 200 square miles, of chalk hills, the greater portion of the rain, about 28 in. in depth per annum, falling on which could be easily obtained for the supply of the metropolis. Supposing, however, that only 12 in. of rain fell over this area, the yield would be 750,000,000 gallons per day for every day in the year. Why, then, he asked, should not all London be supplied with water derived from chalk strata, softened by Clark's process.* The only reasons that have been urged against this being done were two—first, the pecuniary loss that would accrue to the shareholders of the eight companies that now supply London if competition were allowed; and second, a suspicion that uncontaminated water thus derived direct from the subterranean chalk strata would somehow be abstracted from springs that now issue above the level of the sea, and flow direct into the river Thames, the river Lea, and their tributaries. There was no substantial foundation for such a suspicion.

Mr. Richard Hassard, C.E., read a paper, in which he described a scheme propounded by him for bringing water from the lake districts of Cumberland, and from Bala Lake in

* Fully described in the *Builder* for December 15th, 1877 (vol. xxxv., p. 1246).

Wales, for the supply of Liverpool, Manchester, Birmingham, and other large towns. He said he thought the work could only be undertaken by Government intervention. He proposed to impound the water, and bring it to London, passing to the eastward of Manchester to Birmingham, thence along the middle plateau of England to a large reservoir at Edgware at an altitude of 500 ft. or 600 ft. above London. There was nothing unusual, he said, in the project except its magnitude. The distance from Ulleswater to Edgware was 260 miles, but Manchester was at present seeking powers to construct an aqueduct 100 miles in length; Liverpool proposed to bring water from North Wales, a distance of 70 miles; and Paris had recently constructed two aqueducts 168 miles in length; and why, he asked, could not an aqueduct 260 miles in length be constructed for London?

Mr. Hassard concluded his paper as follows:—

"The cost of the undertaking would be:—

For the works of collection and impounding water in the lake districts, and for the main aqueduct to London, &c.	£18,000,000
For the branch aqueduct to Welsh district, and for works connected therewith	2,500,000
	£20,500,000

Say 21,000,000*l.*=52,500*l.* per 1,000,000 gallons daily.

The population, of the different towns and localities, including the metropolis, to whom water might be supplied, number about 8,000,000, and the cost would consequently be at the rate of about 2*l.* 12s. 6d. per individual. In this respect, therefore, as well as in the cost per million gallons daily, the project would compare favourably with any large waterworks hitherto constructed."

Mr. Baldwin Latham, C.E., said that in proposing to supply London with water from the chalk, the existing rights of millowners and others in the neighbourhood of London who now derived their supply of water from wells, ought to be considered. Such, however, was the present state of the law with regard to subterranean waters, that they might be abstracted with impunity, notwithstanding that science was able to ascertain the laws relating to the flow, &c., of subterranean water with the greatest precision.

Mr. Joseph Prestwich, F.R.S., followed with a paper, in which he said:—

"Water-bearing strata, whether consisting of beds of gravel overlying clays, such as the gravel on which London stands, or of the sands of an out-cropping formation, such as the lower tertiary sands under the London clay, or of hills of permeable strata, such as the chalk or oolite ranges, while they absorb and store the rain water to deliver it again in the form of springs, absorb with equal readiness water from any other sources; consequently, to builders in general, what more convenient in constructing a house than to sink a well in one part of the premises for water, and on another part for the house sewage? The works are out of sight; no one thinks of the evil, and few realise it if they see it. But the evil is an accumulative one, and every now and then we are reminded of its existence by disastrous and fatal results. It has grown to such an extent, that almost all the shallower of these sources of water supply are contaminated and injured, and our villages and smaller towns are suffering to an extent which it is difficult to estimate, and which few probably, except geologists, can fully realise. Then, again, the other sources of supply,—our rivers,—have been treated with equal disregard of sanitary principles, and they would, but for timely Parliamentary interference, have suffered equally in consequence. The able sixth report of the Rivers Pollution Commission illustrates in a remarkable manner the consequence of this neglect, whether in the case of our wells or of our rivers.

Fortunately, natural agencies are constantly operating to counteract the evil consequences of our neglect. The power of oxidation and absorption of the soil on underground waters, and of air and light on surface waters, goes far to remedy the evil and restore our springs and rivers to their original purity. The latter having been the subject of successful legislative enactment, it is to be hoped that some similar measure may be applied to our underground springs, for nothing else it seems to me can effect a cure for an evil which is so wide-spread, and at the same time so entirely withdrawn from observation. The arrangements being all below ground, are unknown in most instance to all except the builder, and the well-springs, although often seriously contaminated, yield too often water which is so cool, limpid, and sparkling, as to not only give confidence to the resident, but even to inspire him with a belief in its unusual excellence.

In our larger towns, where cess-pits are gradually being done away with, the wells may improve, if no other source of impurity exists; but in villages and detached houses, where nothing is done, not only do the local underground waters suffer, but it is to be feared the pollution often injures sources having a wider range. Some contrivance for the protection of, and against the contamination of underground waters, used in common by our populations, is as much needed as party-walls are, as a protection against the spread of neighbouring fires.

After some discussion, the resolution printed in our last (p. 535) was agreed to, and the Congress was brought to a close with a vote of thanks to H.R.H. the Prince of Wales for writing the letter which had led to the conference.

Several other papers were contributed to the congress, but were not read or discussed in detail. We shall give summaries of these papers hereafter.

BARNARD CASTLE.

BETWEEN two great mineral districts in the north of England there is placed, sandwich-wise, a tract of land given up to the farmer, the grazier, and the sportsman, but over which is thrown the glamour of the "great unknown" of a past generation. On the east, from the coast to Darlington, there is the pervading presence of the great industry, and near the latter town, the route westward impinges upon the southernmost end of the great coal basin of the north, but beyond that, there is at Barnard Castle a meeting of trade and spade. In the east, iron presents a familiar sight of mine mouths and their machinery, of lofty blast-furnaces, exhaling flame and smoke, and exuding metal so hot that the air around is scorched, and the sky is aglow with the reflection; rolling-mills, where the puddler steams before his furnace, and the shingler, encased in his coat of metal if not of mail, holds the metal for the sounding thud of the steam-hammer, and the mill-men, with the long strips of red-hot iron writhing in the mill, give a weirdness to the aspect of the vast industry. In the west, there are tokens of the same great manufacture, with only the difference arising from the fact that hematite casts it red over the scene.

Between the great hematite region of the Furness district and the mineral deposits of Cleveland and South Durham, there is the region of bleak moorland, fertile dale, and barren crag, commencing near Barnard Castle and terminating beyond Tebay. It is a district which Scott has immortalised, Dickens made notorious, and which preserves in part the appearance of that past in which it played a more active part than it has latterly done. The key to that district is Barnard Castle, which, in the phrase of old Leland, "standeth stately on Teese." To the son of one of the Conqueror's companions the town owes its origin. Bernard Baliol also built the fine old castle on land which the Conqueror had given to his father. The fortress played its part in the days when King John opposed his barons; three centuries ago it underwent that siege which has given proverbial fame to the town, in the days of the rising of the North. It furnished once a royal residence; but now its cliff-crowding ruins furnish only mementoes of the pomp and circumstance of war, and are perhaps best known as furnishing the site whence Scott in "Rokeby" has portrayed a fair scene. Thence, the great poet saw "Stanemore's shapeless swell," "Lunedale wild," and Arkingarth lying "dark afar," the course of Tees, Staindrop from sylvan bowers saluting "proud Raby's battled towers," with other features in a picture so well known as not to need quotation. In such a scene Barnard Castle grew,—agriculture around, lead to its west, coal to its north-east, and iron to the far east. Fell, and forest, and flood give charms of scenery near it, older associations hallow the district, and the domains of Egglestone, Greta, and Bowes give to it perpetual beauty.

The town has not had in it the elements of rapid and continuous growth. Of old textile trades were carried on to some extent—woollen plaids were made; with carpets and thread. Wool died away, from the rise of cotton, and the manufacture of carpets became the staple production of Barnard Castle; and in its turn the latter gave place to the manufacture of Scotch tweeds. This, with the manufacture of shoe thread, for which the place is famed, and attempts to revive the carpet manufactory, with the quarrying of various classes of stone around the town, constitute still the bulk of the special industries carried on. Thus, the 3,581 inhabitants of the chapelry in 1821 had grown only to 4,430 in 1831, and at the date of the last census even there had not been much growth, for the town had given up something of its vitality to swell the stream of lusty life that had flown to the east. In forty years, however, the attractions of the town have been increased; its institutions have been extended; it has taken a new lease of life; is widening its bounds, and on the next enumeration of its people its record will be probably of a larger population. Forty years ago its chapel was "not remarkable for anything save its antiquity"; it had a market, a mechanics' institute, a national school, and a book society; there were flax-dressers and curriers, hat-makers and dyers, and these, with weavers and nailmakers, formed the bulk of the special traders of the town. A mail-gig ran east and west, coaches made the town a stopping stage between Manchester and Liverpool thrice a week, and it continued to doze in the midst of its beautiful scenery regardless of the fact that its beauty should have been its dower. That fact has impressed itself upon the town since then; and not neglecting its mills or its quarries, it is adding thereto other aids to its own prosperity, and generous donors are assisting it. Few towns of its size can boast of greater architectural attractions now than Barnard Castle, and thus the change from the stone cottages, thatch-roofed, of a score or two of years ago is most complete. The church is restored and its tower rebuilt; a fine building, the Free Christian Church, has been erected; a grammar-school is meditated; a Masonic Hall has been built; with new offices, villas, and banks. It 1869 the foundation-stone of a magnificent museum was laid by the Countess de Montalbo, the wife of one of the wealthy coal-owners of the neighbourhood, which now approaches completion, and which, for magnitude, extent, completeness, and appearance promises to be one of the finest in the kingdom. With a principal front 300 ft. long; a central dome, half that height; with picture-galleries, 200 ft. long, and sculpture-galleries as extensive, and with stores and treasures gathered from far and near for it, this splendid building, the estimated cost of which is, with its chapel, 100,000*l.*, is at once a proof of the taste and skill of its designer, and of the munificence of those who have founded it for the people amongst whom they have long dwelt. We have before now given illustrations of the building.

Years ago, after a long struggle, the railway system was extended from the east to Barnard Castle, and it acquired communication with the coal country round Auckland. Since then the moors and morasses beyond Bowes have been traversed by the line, and a communication has been thus made between the east and the west, whilst a small local line penetrates into the lead-mining district of Teesdale. The large union of Teesdale comprises 178,346 acres,—the greatest area of any in Durham or the North Riding of Yorkshire; and its population of 20,000 is practically a stationary one; its pauperism is also stationary, at about 110 indoor and 500 outdoor paupers, so that it has the credit of having a larger proportion of pauperism than most of its adjoining unions. It has, however, to counterbalance this, a very low death-rate; and though its birth-rate is equally low, yet the provision of a better water-supply, as well as of other sanitary measures, has considerably improved the health of the town and of the district. There are no tokens of the very great increase of Barnard Castle in the immediate future. It is becoming, it is true, more and more a health resort; and the grand and varying scenery around it,—its combination of wood and water, of fertile dale and bleak moorland,—as well as the mode in which these have been hallowed, give to it very great attractions in this respect; which it moots adding to by erecting a hydropathic establishment. It is utilising the stores of limestone, of whinstone, and of freestone around it; whilst its older trades drag on the even tenour of their way. It is the centre of a good agricultural district, and to it the dalesmen resort from Middleton and other places with their leaden produce. Becoming also, in a small way, a railway junction, it is beginning to derive the advantages which the troops of tourists that follow the footsteps of Scott bring. And to understand either its position or its prospects aright, it should be compared, not with iron-built towns like Middlesbrough, or prosperous coal and timber ports like West Hartlepool, but with towns of its own calibre, such as "Royal Staindrop," and it will then be seen that old Barnard Castle has found out that to stand still is to go back in the race, and thus it is preparing again to advance in the rank of northern towns.

Chippenham Fountain.—The tender of Messrs. J. Easton & Son for the above has been accepted. It is to be executed in red and grey granite, with parts polished; the lowermost basin will serve as drinking-trough for horses, and will be 15 ft. in diameter,—it will also have recesses for dogs. The central shaft is to be ornamented with eight polished shafts with carved caps. Three ornamental lamps will form a finish to the structure, which will be 17 ft. high. The architect is Mr. W. Galsworthy Davie, of London.

THE RIGHTS OF VENDORS, PURCHASERS, AND INSURANCE COMPANIES IN REGARD TO BUILDINGS INJURED OR DESTROYED BY FIRE.

THERE has probably been no time when building operations were more actively carried on than the present, in spite of the general dulness of trade, not only in this country, but also on the Continent. Points, therefore, which are of vital importance to the owners of buildings, and especially of dwelling-houses, require to be noted with some care and accuracy. Thus it may not be out of place to dwell for a moment upon some matters regarding the insurance of buildings against fire.

Every prudent owner, we suppose, insures the buildings which are his property, and it is very essential, therefore, that he should fully understand the extent of his rights under policies of insurance. The actual point to which we desire to call our readers' attention is one of quite a simple character, but for that reason it does not lose in importance; this is, indeed, only a greater reason why it should be well comprehended by those who may be affected by it.

Assume, then, that the owner of what we may as well call a dwelling-house insures such house by the usual annually terminable policy, and that during the continuance of such policy he has entered into an agreement to sell the property in question, which would, of course, in equity, give the would-be vendor or purchaser a right to have the contract fulfilled; practically, therefore, that he has sold it, but that he is still without the purchase money, upon payment of which the contract is usually complete, and consequently is an unpaid vendor with a lien on, or, in untechnical language, a right to keep, the property until paid by the purchaser.

These are facts occurring every day, and of the most ordinary occurrence. Next let us assume that during this period,—that is, of a continuance of a policy, a sale, and thirdly, the non-payment, and, therefore, the non-completion of the contract,—a fire occurs. The question then arises, has the insurer a right to require a payment of the amount from the person or company with whom he has insured the property? It is obvious that, on the one hand, he has not parted with the possession of his property, and that he is entitled to be considered owner of it, yet, on the other, that the purchaser, if the vendor refused to fulfil his contract, could at any time invoke the aid of the law courts to compel the contract to be fulfilled. It seems equally obvious, therefore, that the holder, as it may be convenient to call him, does not possess all the rights of an ordinary unfettered owner of property, and that, therefore, there is a certain ground for the contention that he cannot require an insurance company to pay the amount for which he is insured. But since he is in possession of the premises he clearly possesses a tangible and very important interest in the property, and one which entitles him to be paid the amount due. For it may be tested in this way,—Suppose that the purchaser did not complete, or could not complete, his contract, that the property is destroyed by fire, and that the vendor cannot recover from the insurance company. It is clear that he then loses the whole benefit of the money which he expects to recover, and equally also that he is just as much an owner of the property as if no negotiations for its sale had ever been entered into. Therefore, we have no doubt at all that the judgment in the recently decided case upon which these remarks are based, of Collingridge *v.* The Royal Exchange Assurance Corporation, 3 Law Reports, Q.B.D., 173, is perfectly correct, namely, that the unpaid owner can recover from the assurers. The result, too, of this decision is quite certain to be just in its operation, and a decision in the opposite direction would have been most unfortunate.

But whilst the unpaid vendor can thus,—it is now decided,—recover the amount for which he is insured, it seems pretty clear that he would not be able to keep the money, and put it into his own pocket, merely handing over to the purchaser the blackened shell of a house. Here we see the effect of the comparative semi-ownership which is all he possesses. He retains the house *until* the purchase-money is paid, but the purchaser has a right to the house, and equally therefore, regarded from the point of view of equity, the vendor must be considered as a trustee for the purchaser of the money received from the insurance company. For, be it observed that the contract is to make good a loss to the buildings and house; and, as the purchaser has a certain right, when he does certain acts, to the possession of these buildings, it seems equally clear that he is entitled to the money to reinstate them in the condition in which they were before the fire destroyed or injured them. Try this again by a very practical test. If the vendor could compel an insurance company to pay up the amount for which the premises are insured, and likewise keep the money so received for his own use, and also compel a purchaser to take the injured property, we should have this practical result, that if a building worth 1,000*l.* were agreed to be sold for that amount, and also insured for the same sum, the vendor would, if it were destroyed, actually be a gainer of 1,000*l.* over and above the value of the property sold,—a result which would be an enormous premium on fraudulent claims, and even on the destruction of buildings themselves, and utterly unjust towards the purchaser. For if the vendor is only the trustee of the money received for the purchaser, it is obvious that the result is one of a perfectly just character: the vendor has his purchase-money and the purchaser has his property, and, if injured, a certain pecuniary equivalent for that part which has been injured or destroyed by the fire. Both these points, upon which we have shortly commented, as they now stand, seem therefore to be correct as regards legal principles, and based upon equity and right.

IRON BRIDGES OF LARGE SPANS.

THE INSTITUTION OF CIVIL ENGINEERS.

AT the meeting on Tuesday, the 28th of May, a paper read at the previous meeting on "The Design generally of Iron Bridges of very large Spans for Railway Traffic," by Mr. T. C. Clarke, C.E., of Philadelphia, was discussed. We give a few notes of the paper.

Two of the latest and best examples of American long-span iron bridge constructions were chosen for illustration. One was the trussed girder bridge across the Ohio River at Cincinnati, for the Southern Railway,—515 ft. between the bearings, and erected on temporary staging of timber,—designed and executed by Mr. J. H. Linville. The other was the bridge of three spans of 375 ft. each, carrying the same railway across the Kentucky river, the engineer in this case being Mr. C. Shaler Smith. Both bridges were noteworthy for their economical design, and for their comparatively small amount of dead weight.

The Ohio Bridge consisted entirely of rolled iron, pin-connected. The girders were quadrangular, each 51 ft. 6 in. deep, the panels being 25 ft. 9 in. long, and the girders 20 ft. apart from centre to centre. The weight of iron in the span of 515 ft. was 1,176 tons. With a total load of 431 tons, the centre deflection of the east truss was $2\frac{9}{32}$ in., with a permanent set of $\frac{1}{16}$ in., that of the west truss being 2 in., with no permanent set.

Advantage was taken by the engineer of the Kentucky River Bridge, of two towers and sets of anchorage, formerly constructed for a suspension bridge across the cañon, which had not been completed. The first panel of this bridge on each side was bolted to the towers, and was then corbelled out panel by panel. The towers were calculated to be strong enough to carry 196 ft. of projecting spans. At this point the spans were supported by temporary towers of wood. The corbelling out process was continued until the above spans each reached the main iron piers, which were built up simultaneously, so that the two met in mid-air. Each half of the centre span was then corbelled out as before, until they met in the centre. At this stage of the work, the upper chords being in tension and the lower in compression, the former were nearer to each other than the latter by a few inches. The method of closing the gaps under the changes resulting from alterations of temperature was then described. Up to this time the bridge was a girder 1,125 ft. long, continuous over three spans. But while the abutments on the cliffs were stationary, the iron piers rose and fell under changes of temperature, and so varied the strains on the web system. The shore spans were therefore hinged at points 75 ft. from the piers, leaving a centre girder 525 ft. long, supported by piers 375 ft. apart. Both of the web systems of diagonal rods were consolidated into one member at the point of contrary-flexure, and were separated again after the hinge was passed. When the bridge was tested it was found that the movement of the lower chord tenons under the passing load was $1\frac{1}{4}$ in. Every effort was made to secure the uniformity of the modulus of elasticity of every part of the iron-work. Nevertheless, the variation in length, between the east and west chords, was 1 in. in 1,125 ft. When the end-spans were loaded with 277 tons, and the centre-span unloaded, the central deflection was 1·52 in., and the upward movement of the central span was 2·83 in. With the centre-span loaded with 331 tons, and the end-spans unloaded, the central deflection was 3·5 in., and the upward movement of the cantilever was 1·58 in. With all the spans loaded, 814 tons in 904 ft., the centre-deflection of the centre-span was 1·62 in. The Kentucky River Bridge occupied four months and four days in erection, the average number of workmen employed being fifty-three. The average cost of erection was about 2*l.* 10*s.* per ton. The weight of iron in the bridge was 3,654,271 lb. The depth of the truss was 37 ft. 6 in. and its width was 18 ft. The iron pier at the base was 28 ft. by 71 ft. 6 in.; at the top it was 1 ft. by 18 ft.; and it was 177 ft. 3 in. high. This was one of the boldest and most original pieces of bridge engineering in America.

Finally, the author stated that the workmanship of long-span bridges in the United States was generally first-class; and that the price of American bridge work had fallen year by year, from 40*l.* 6*s.* per ton in 1870 to 20*l.* 16*s.* per ton in 1877.

LIGHTHOUSE BUILDING.

SOME time since, the *Builder* called attention to the dispute between the Trinity House Corporation and the Maritime Corporations of the Bristol Channel seaboard, respecting the building of a lighthouse.

Despite the opposition of the Maritime Corporations, the Tower-hill authorities have commenced building a lighthouse on Bull Point, Morthoe, which will consist of a circular tower 30 ft. high, in two floors of 13 ft. diameter. On the sea-side of the tower will be the engine-room, workshop, and coke store, the former of which will be supplied with caloric engines for driving a fog-horn, similar to the one used at St. Catherine's Lighthouse, Isle of Wight.

On the land-side of the tower will be the dwellings, which are to be occupied by two married keepers and one unmarried assistant. The dwellings and the machine-room will be connected with the tower by passages running at right angles from the centre of the tower. On the top of the tower will be fixed the light, accessible by a granite staircase, and surrounded by an iron balcony. The light is to be a revolving one, and will shine clear of Morte Stone,—the site chosen for a lighthouse by the Maritime Corporations,—and the Capstone Hill at Ilfracombe. The whole of the building, with a garden, will occupy a superficial area of 12,000 ft.

The building is now far advanced, and is expected to be complete by Christmas next. It is to be constructed of local stone and blue lias lime, and will be cemented on the outside with Portland cement.

Delabole stone will be used for the floors, and granite and Forest of Dean stone for the steps, the dressings being brick. The whole of the gravel used for the works is obtained from the beach below, a depth of 150 ft., from which place it is conveyed over an almost perpendicular tramway in a truck hauled up by a 6-horse power steam-engine. The amount of the contract is 7,000*l.*

PROTECTION FROM THE SEA.

THOSE who are interested in seaside property, and are trembling at the falling away of the beach and the coming up of the sea, may be glad to hear of what has taken place at Walton-on-the-Naze. Ever since Mr. Robert Warner, the proprietor of a considerable amount of land in the place, put out a stone pier, it has been observed that there has been a constant influx of clean sand, which has made the small hamlet extend into a considerable seaside resort. Quite lately the sand has increased greatly. It is now some years since the work was completed, and it has proved a wonderful protection to the cliffs, and brought about a great accumulation of sand or foreshore. It is urged that by a few such stone piers dotted about any coast encroachments by the sea would be prevented.

THE PRESERVATION OF IRON.

WHEN the discoverer of a principle or a process allows time to pass away without making practical application of it, the chances are that some one else will find the means of doing so without him. Our readers may remember the process of preserving iron by means of a coating of its own oxide, recently introduced by Professor Barff, mentioned by us as promising great results. Mr. George Bower, of St. Neot's, has now hit upon another and simpler mode of doing the same thing, and his specimens yield nothing in appearance to the samples of Professor Barff, and their protective coating is said to be equal in efficiency, since it is identical in chemical composition. The process by which they are prepared consists in exposing the iron at a suitably elevated temperature to the action of the oxygen of the air. This action forms a coating of the oxide known to chemists as magnetic oxide of iron, which is incapable of change under any ordinary conditions. It has not been generally known that free oxygen, as it exists in the atmosphere, is capable of coating, under suitable conditions, the surface of the iron with the same oxide as that yielded by steam. The method adopted in carrying out this process is to place the articles in a chamber, which is capable of being completely closed, and gradually raise the temperature to the requisite degree, ranging between a dull and a bright red heat, according to the ultimate use to which the articles may be applied. Air is then passed in, and the chamber completely closed for one hour, when the inlet and outlet pipes are again opened, and a fresh supply of air sent into the chamber, which is again closed. This renewal of the air at the end of every hour is continued until the required thickness of magnetic oxide is formed on the iron.

The coating given by the use of air is of an agreeable greyish or neutral tint, so that for many purposes the necessity of further ornamentation by painting is dispensed with. The coating has been tested under the severest conditions, and has always resisted most completely all attempts to set up rusting. Theoretically, the process stands examination, but the actual effect of long-continued exposure has yet to be tried. An accident in the first instance led Mr. Bower to this interesting discovery, but the process in its present shape is the result of a long series of experiments conducted by Mr. Tweedie.

THE GIPSY NUISANCE.

SIR,—I am truly glad to find that the gipsy nuisance is being ventilated, as the loss to builders is such that in some cases it leads to bankruptcy and entire ruin. Some years ago I had four houses empty nearly two years through the proximity of the gipsies. Not only is their encampment filthy, but my front gardens were made the receptacles of their filth. Their thieving, fighting, language, and almost every habit, is enough to arouse every civilised person. Where is the power of the School Board to allow dirty boys and girls, some bordering on man and womanhood, to play and roam all day, to the terror of all decent children? Few people except the builders in new neighbourhoods know the loss occasioned by them. Sometimes whole streets are depopulated by their persistently keeping in the locality.

If instead of sending our money and men abroad to civilise the heathen, we began at home, and by some powerful means try our hands upon the gipsies, we should do much to improve the lovely suburbs of London. Is it too mean a subject for our legislators to give a few hours' attention to? If you will kindly lend your powerful aid, you will render a great boon to many struggling builders who would build good houses in open and healthy localities, but from fear of those nomads they build only cheap and nasty ones.

W. N.

Paris Exhibition: Protection against Fire.—There are several steam fire-engines and fire-engines of a smaller class exhibited at the Paris Exhibition,—notably those from the establishment of Messrs. Merryweather & Sons. This firm has placed at the disposal of the Commissioners some eight or a dozen engines, large and small, for the protection of the building against fire. There is in attendance a fireman from the staff of the above firm.

BURGOS AND ITS BUILDINGS.*

THE town of Burgos is situated on the banks of the river Arlanza, along which are some small gardens used as a public promenade. The houses are mostly built of brick and painted white, with the usual Spanish balconies before most of the windows, which are all enclosed in and glazed like little greenhouses attached to the wall; there is an irregularly-shaped plaza, surrounded by a piazza, in the centre of which a band occasionally plays. The peasant inhabitants are interesting, with their dignified tattered cloaks, dark Spanish faces, and bits of lace for bonnets; but the interest of the place certainly culminates in the magnificent ecclesiastical monuments of the town and neighbourhood.

The cathedral must certainly be reckoned as one of the finest in Europe, both from its size and general appearance, both externally and internally, and from the amazing richness and exuberance of fancy displayed in the details. It is said that the first stone was laid by Bishop Maurice, an Englishman by birth, in 1221. The west front has been sadly mutilated by cutting away the old deeply-recessed Gothic arches, and substituting the present miserable pseudo-Classic ones; but the upper part, with the graceful open-work spires, which rise to a height of 300 ft., centre rose window and coupled window, with its geometrical tracery over, and adorned with a great number of statues,—the whole cut in white marble-like stone from Ontoria,—has a rich and charming effect. The upper parts of this façade are said to be the work of Juan de Colonia (Cologne), date 1442, and the open-work spires were probably inspired by the monster cathedral of the Rhine, though still incomplete. It may, perhaps, be objected that these spires finish somewhat abruptly, but the little crown-like balcony just below the apex appears to me to be a pleasing feature.

The cathedral is surrounded by houses and buildings, so that its general effect can never be seen as a whole, except at a distance, where it towers above the surrounding objects. The site is peculiar. The cathedral is built on the side of a steep hill, so that at the west end you are level with the surrounding ground; at the south transepts you have to ascend some thirty steps to reach the floor level, and the cloisters on this side are on the second story, the lower one being devoted to workshops, or secular use; but on the north side the cathedral is some 15 ft. or 16 ft. below the surrounding ground, and from the door in the north transept you have to descend by a great number of steps into the cathedral. The Puerta del Sarmental, or entrance to south transept, is very fine and impressive; the two walls on either hand of the cloister and archbishop's palace tower up to a great height, and are relieved at the angles by turrets, corbelled out, of pure and graceful design. A noble flight of steps leads up to the façade of the transept, the apparent height of which is, of course, increased by this peculiarity of the ground. There is a fine doorway richly decorated with sculpture, and above a rose window, the whole crowned with a noble triplet decorated with tracery flanked by corner turrets, the whole of the purest and richest design. Another view of the interior is gained from the north-east side of the Chapel of the Constable, which is octagonal, and not unlike the central spire in outline, though somewhat lower, with huge ornamental pinnacles. A passage leads round to the north side to the transept door, called Puerta de la Pellegeria, situated on the same level as the church floor, and which is much more used than the door at the top of the steps above alluded to.

Entering the interior, we observe first the curious arrangement of the choir, which is peculiarly Spanish, and consists of a church within a church. The choir is, west of the transept, enclosed by a lofty screen-wall, and there is no entrance to it except from the lantern. The high chapel containing the high altar occupies the central portion of the church east of the transept, also surrounded by high screen walls. The floor under the lantern is enclosed from the transepts by magnificent brass rail-screens, called "Rejas."

During the time of service the great body of the faithful are in the transepts, and processions backward and forward take place between the high chapel and the choir. It is rather curious that Westminster Abbey is arranged very much on this plan, but in that case there is a western door to the choir, and a very long nave west of it; whereas, in Burgos, on entering the western door of the cathedral, one is brought facing at no great distance the blank outside wall of the choir, which is certainly objectionable, and on this account the transept entrance is far more impressive.

Perhaps the gem of the whole cathedral, both inside and out, is the magnificent lantern, which is, perhaps, without a parallel. Charles V. said "it ought to be placed in a case, and not seen as ordinary works"; and Philip said "it was rather the work of angels than of men." It was designed by Philip Vigarni, a Burgalese, and was also executed by two natives of Burgos, and it was finished in 1687. The main arches are carried on four massive columns with octagonal bases, which are decorated with mezzo-relievo allegorical subjects. The statues in the niches are apostles and fathers of the church,—twenty in number. It may be objected that the details of this, and, indeed, the whole lantern, are of debased style; and they certainly do present so strange a mixture of Gothic and Renaissance work that a rigid purist could not bring himself, perhaps, to admire it. These four columns seem to me to have a massive appearance, which forms an admirable foundation for the lofty lantern above. Above the main arches the superstructure is brought to an octagon by means of pendentives, ornamented in a radiating manner,—an arrangement which seems very judicious. Round the octagon runs the inscription in Latin, "I will praise Thee in Thy temple, and will glorify Thy name, Thou whose works are miracles," in plain raised letters of Roman character. Above this the lantern is divided into three stages, the lower one containing shields of arms supported by figures, and the two upper ones two-light windows, with Gothic tracery. At the angles are figures in niches, all of excellent execution, and below the two rows of windows are balconies running round the octagon.

The vaulting deserves special attention, on account of its peculiarity. The ceiling is flat, and filled in with tracery of an elaborate description, either pierced right through or in front of a black ground; this is supported by vaulting ribs, with vertical open-work tracery over them, and collected on plan in the shape of a double octagon star, and ornamented at the crossings with highly carved bosses.

The choir contains 103 walnut stalls, divided into two tiers, in Renaissance style, and elaborately carved with various Biblical scenes. The date is from 1497 to 1512. In the high chapel the high altar is Italian, and not very interesting. In front of it are two elegant brass pulpits or lecterns, one for reading the gospel, the other the epistle. The cathedral is surrounded by fifteen chapels, built in different periods, which I will describe in detail, beginning from the west end on the north. No. 1. Chapel de Sta. Tecla; this is in the Late Italian, with the most gorgeously vaulted roof and dome, verging towards gaudiness; it was finished in 1734. No. 2. Chapel of St. Anna, containing a sculptured genealogical tree of Christ, and a fine Gothic altar. Passing the transept, we see the fine flight of steps in Renaissance mixed style, something like that of the lantern leading up to the transept; they are richly decorated with sculptured foliage, children, draperies, &c. Passing by the other chapels on the north side, we come to the most noted in the whole cathedral, the Capilla del Constable. The Constable, like the Lord High Constable of England, used to regulate all matters of chivalry, and bore the royal standard in battle. This chapel was founded by the Count of Haro, and, like the west end, was designed by Juan de Colonia. The entrance is under a semicircular arch richly decorated, beneath which is a railing of the most exquisite Renaissance work—date, 1523. The plan of the chapel is octagonal. Internally, it is divided into three compartments in height. The wall-spaces of the lower, where not occupied by altars, are ornamented with coats of arms and somewhat coarse sculptured foliage; the next stage contains a series of arches ornamented with a most elaborate band of sculptured figures and foliage,—a feature which is often reproduced in Burgos, and the upper stage contains a series of traceried windows. Some of the foliage running up between the hollows of the columns and string-courses is extremely delicate and beautiful, as also are the statues and canopies on either side of the pillars. The vault-

* From a paper entitled "To Burgos and Back," read by Mr. Alexander Payne before the Architectural Association, on the 24th ult.

ing of this and the other chapels is peculiar. The ribs form a more ornamented pattern than those of northern vaults on plan, and the central compartments are filled in by minute and elaborate tracery, on a black ground, and having the appearance of being pierced through; the bosses are picked out in gold and colours, and the whole forms a very rich and characteristic roof. In the centre of the Chapel of the Constable are the tombs of the founders, of jasper, with effigies of Carrara marble. They were sculptured in Italy in 1540, and represent the Constable, the Viceroy of Castile, in full armour, and his wife. The elaborateness of the details of the armour, and of the embroidery of the cushions, gloves, and dresses, is wonderful, and almost approaches the minute magnificence of the tombs of Cartuga. The large chapel south of the Constable's Chapel, called the Chapel of Santiago, is now used as a parish church. There is not much interest in the other chapels north of the cloisters except a fine tomb and lectern in that of St. Henrique. The chapel of St. Christo is named after a celebrated crucifix, traditionally said to have been carved by Nicodemus. This image is said to have performed numerous miracles, and, according to local tradition, it perspires on Fridays, and sometimes bleeds.

The cloisters, which date from the fourteenth century, are extremely interesting; there is no interior garden, as they are on the second story, and the lower part is occupied by workshops, which form a square of about 89 ft. in each direction, and the gallery is 22 ft. wide. The door leading from the transept to the cloisters is extremely rich and beautiful, and has Christ's entrance into Jerusalem, and other Biblical and allegorical scenes, carved on it in deep relief; on each side are four statues of David, Isaiah, Gabriel, and the Virgin. The arches of the wall arcade are enriched with an excellently-carved band of foliage, and the cloister contains many interesting and elegant tombs. On the east side is a door leading to the chapel of St. Catherine, a large room about 43 ft. square, and brought to an octagon at the groining by curious tripartite vaulting, which Mr. Street alludes to as being a characteristic Spanish feature.

The cathedral contains 7 staircases, 112 windows, 36 railings, 144 pictures, more than 60 tombs, 7 organs, 9 baptismal fonts, 9 choirs and 9 lecterns, 10 confessionals, 44 altars, and nearly 100 full length statues.

After the cathedral, perhaps the most interesting objects in Burgos are the tombs of the Miraflores, in the Convent of La Cartuza, above two miles and a half from the town, and situated on a low, sandy hill. Though once wealthy, the convent is now very much neglected, and only inhabited by a few slovenly-looking monks. The church was designed by Juan de Colonia, the architect who built much of the cathedral. The style is simple and elegant. The building has a nave without aisles, with an apse at the east end, pointed tracery windows, and some mixed details. The great glory of the place, however, is the tombs, perhaps the finest in Europe. The centre tomb, that of King Juan II. and Queen Isabella of Portugal, forms an octagon star on plan. At the angles are coats of arms, each supported by two lions, between which are seated statues of the various Virtues, the canopies over which, with the buttresses between them, are perfect marvels of delicate workmanship. The moulding which caps the lower part of the tomb is ornamented with graceful foliage; on four corners are seated figures of the Evangelists. In the recumbent effigies of the king and queen, with their robes and crowns and cushions, the sculptor has almost surpassed himself, and the effect of this in glistening white marble can only be compared to point-lace work in stone. At the feet of the queen is a group of a lion, child, and dog. The other tomb is that of the son of Don Juan II., the Infante Don Alonzo. The figure is represented in a kneeling attitude, and the robes and altar are carved with a richness almost equal to that of the recumbent statues. The wall behind the tomb is divided into square compartments, and richly carved. There is a fringe of elegant foliage, representing a vine twined round the arch of the tomb, in the festoons of which children are sculptured plucking the grapes. Unfortunately, part of this beautiful work is broken away. The arch is elliptical below, and finished with a very deep ogee hood-mould. In the tympanum is St. George or St. Michael contending with the dragon. The sculpture in the mouldings, and of the canopies and niches on either side, and especially of the magnificent crockets of the hood-moulding, is exceedingly rich and elaborate.

The interior of the church is divided into three parts, according to the rule observed by the Carthusian order. One is allotted to the monks, another to the lay brethren, and a third to the people. The two first are fitted with stalls, elaborately carved. Those of the inner choir are of walnut, by Martin Sauchery, date 1488, and have fine and minute tracery. Those in the choir of the lay brethren are later, and in the Renaissance style. The tombs were designed by the celebrated Gil de Liloe, date 1493.

There is another convent near Burgos, on the opposite side of the town, and about a mile and a half from it, called Las Huelgas, which is interesting, on account of its Early Pointed church, the nave of which is entirely reserved for the nuns, and can only be seen through the screen; the transepts and chapels are open to strangers. In the latter may be seen another instance of the tripartite vaulting mentioned when describing the Chapel of the Constable. The interior cannot be visited on account of the strictness of the discipline. There is, it is said, a very interesting cloister in the interior, of Romanesque character.

The other churches of Burgos are inferior in interest to those described, though they contain several fine tombs and retables. The stone reredos in the church of St. Nicholas, near the west end of the cathedral, is scarcely surpassed in richness by anything in the town.

Among secular buildings and monuments may be mentioned the Arco de Sta. Maria, a gateway leading into the town. It was erected by the Burgalese on the occasion of a visit of Charles V., and is decorated with statues of popular heroes. It is ornamented with turrets and battlements, and circular bastions.

There is not much of interest among the old houses of Burgos. The late Sir Digby Wyatt gives a sketch of one in his "Notes on Spain," the Casa de Miranda, with a fine courtyard and columns. The castle is worth mentioning, on account of the struggle that took place between the French and English in the Peninsular War; but it is now in ruins, and presents little of interest to the architect. It was blown up by the French on their retreat before the victorious Duke of Wellington, and it was at that terrible explosion that several streets and much of the beautiful stained glass of the cathedral were destroyed.

In forming an estimate of the value to the student of the architectural buildings of Burgos and the neighbourhood, it may be conceded at once that those who are wedded to one particular period of art, or who seek for strict purity of architectural style, will probably not find much to please them there. There is about most of the buildings just described an exuberance of fancy and a disregard of precedent beyond what is to be found in the more rigid schools of the north; but those who are ready to appreciate bold effects and graceful detail, wherever they find them, whether according with preconceived notions or not, will find much to admire and much to learn in the old capital of Castile.

HEATING TOWNS FROM A COMMON CENTRE.

WE have heard from several quarters of the heating of houses in Lockport, New York State, by steam laid on from a common centre by the Holly Steam Combination Company, and Mr. George Maw has now sent to the *Times* some additional particulars. Mr. Maw says,—"The experimental works in Lockport were commenced last year, and during the late winter about 200 houses in the city were heated from the central supply, through about three miles of piping, radiating from the boiler-house, containing two boilers 16 ft. by 5 ft., and one boiler 6 ft. by 8 ft. These boilers were during the winter fired to a pressure of 35 lb. to the inch, with a consumption of four tons of anthracite, costing 4½ dollars a ton; during the summer but one boiler is fired, consuming a ton and a half of anthracite in twenty-four hours, and a pressure of 25 lb. per inch maintained.

The boiler pressure of 35 lb. in winter and 25 lb. in summer is maintained through the entire length of the three miles of piping up to the points of consumption, where there is a cut-off under the control of the consumers. The first 600 ft. of mains from the boilers are but 4 in. in diameter. There are 1,400 ft. of 3-in. pipes, 1,500 ft. of 2½-in. pipes, and 2,000 ft. of 2-in. pipes. The supply-pipes from these mains to the houses are 1¼ in. in diameter, and within each house ¾-inch pipes are used. In addition to the cut-off tap from the main under the control of the consumer there is a pressure-valve regulated to a 5 lb. pressure under the control of the company, and beyond this is an ingeniously constructed meter, which not only indicates the total consumption in cubic feet of steam, but also the quantity of steam used in each apartment. At each 100 ft. of main an expansion valve, like an ordinary piston and socket, is inserted, allowing an expansion in each section of 100 ft. of 1¾ in. for the heat at 35 lb. pressure. No condensation whatever occurs in the mains. They are covered with a thin layer of asbestos paper next the iron, then a wrapping of "Russian felt," and finally wrapped round with "Manilla paper" like smooth light-brown paper over all, and the whole encased in timber bored out three-quarters of an inch larger than the felt-covered pipes, and laid along the streets like gas-pipes.

The distribution of heat in the apartments is by means of radiators, consisting of inch pipes 30 in. long placed vertically either in a circle or as a double row, and connected together top and bottom, with an outlet pipe for the condensed water which escapes at a temperature at a little below boiling, and is sufficient for all the domestic purposes of the house, or is used as accessory heating power for horticultural and other purposes.

BROUGHTON CASTLE AND CHURCH.

SIR,—In Brewer's description of Oxfordshire, 1814, it is stated that, "two miles on the south-west of Banbury, is Broughton Castle. The manor of Broughton formerly belonged to the family of De Broughton, who probably took their surname from the place, and who obtained a charter of free warren here about the 29th of Edward I. It was afterwards vested in the family of Wykeham. Margaret, the daughter and heir of Sir William Wykham, carried the property in marriage to Sir William Fiennes, Lord Saye and Sele." This castle is surrounded by a moat, over which is a stone bridge of two arches. The eastern entrance to the court is formed by an ancient tower, yet extant. The eastern side of the castle is believed to have been erected by the Broughton family in the reign of Edward I. The north front was built A.D. 1544. One of the towers on the south-east angle has loopholes for discharging arrows. No portcullis appears in the outer gateway. A gold ring has been found under a beech-tree, near this castle. On this ring a knight, cross-legged, and having a shield with the arms of St. John of Jerusalem, was engraved. These words, in Norman-French, were engraved on a scroll:—"Joie sans ni cesse"; that is, "Joy without cease."

In Gardner's "History of Oxfordshire," 1852, this castle is described (pp. 620-2). It is stated that the hall has a pendent ceiling, being 55 ft. long and nearly 26 ft. wide. In Beesley's "History of Banbury," 1841, pp. 100-10, 294-7, this castle is described, with an engraving. The chapel is stated to be ancient, having an east window of the Decorated style, with geometrical tracery of the fourteenth century. Under the window is the stone altar, consisting of a slab supported on three plain corbels; the slab retains the crosses marked on the surface of an altar in the time of the Roman Catholic religion, before the Reformation. Skelton's "Oxfordshire" contains several views of Broughton Castle, and an engraving of the seal above mentioned. In Sir J. B. Burke's "Visitation of Seats and Arms," vol. i. (1852), pp. 135-8, this ancient castle is described and engraved. It is stated, "In visiting Broughton its church should not be forgotten. This noble relic stands near the bridge and tower leading to the castle, and possesses an interest from its antiquity, belonging to the thirteenth century." Beesley described it as "a valuable specimen of the Decorated style of the fourteenth century. The spire is a broach; it rises from the tower without intervening parapet or pinnacles at the angles. It contains several monuments, including one of the reign of Edward II., engraved in Skelton's "Oxfordshire." This work also contains an interior view of the church, which includes the Wykeham Monument of the time of Henry VI. in the chancel (see "Glossary of Architecture," 1840, plate 98). Mr. Anthony Wood stated that Lord Saye,—of Broughton,—

the opponent of Charles I., "after he had spent eighty years, mostly in an unquiet and discontented condition, &c., did die quietly in his bed on the 14th of April, 1662, whereupon his body was buried in Broughton Church, among the graves of his ancestors, and had over it a rich and costly monument erected more befitting a hero than a rebel." This ancient edifice is only a few miles south of Wroxham Abbey, another interesting specimen of architecture described by me in the *Builder*, vol. xxxiii., p. 284. Compton Wynyate (*Builder*, vol. xxxii., p. 484), although in Warwickshire, is only eight miles north-west of Broughton. C. C.

OAK OR CHESTNUT?

DOES the decorative foliage of the end of the thirteenth century and of the fourteenth century, in which natural types were closely imitated,—supply any specimens of chestnut leaves? If the tree was frequently under the eyes of the carvers of that time, such leaves would not be likely to be entirely absent. It has been suggested that the leaves of the *Castanea vesca* are not so individual in character as to tempt carvers to their reproduction. But the discovery may perhaps be made, and would be worth making, in connexion with this controversy to which Mr. Blashill has given new life and a practical bearing; and perhaps in connexion with decorative foliage generally, as showing why certain natural forms stirred the fancy of the Mediæval workmen, and lent themselves to rendering in wood or stone. A.R.I.B.A.

NEW WELSH CHAPEL.

ON the 15th ult., the memorial stone of a new chapel was laid by Mr. D. Davies, M.P., in Bridgwater-square, Barbican. The original church was founded by the Welsh Calvinistic Methodists in Smithfield, in 1744, and after removal to Wilderness-row for thirty-seven years was located in Jewin-crescent for fifty-four years.

The new chapel when completed will seat about 650 persons on the ground-floor and in the galleries; the basement contains school and class rooms; and there are also vestries and rooms for the chapel-keeper. The walls are of brick, faced with Kentish rag, the dressings being of Portland stone.

The floor of the chapel is of fireproof construction, and (with the iron girders) has been supplied by Mr. A. D. Dawnay, of Queen-street, Cheapside.

The style is Early Gothic, with a tower and slated spire rising some 90 ft. The contractors are Messrs. Browne & Robinson, of Worship-street; and the architect is Mr. Charles Bell.

The site and building will each cost about 5,000*l.*

A JOBBING BRICKLAYER'S VIEW OF THINGS EVIL.

AN aged and practical jobbing bricklayer, in business at Pimlico, declares that the best friends to his craft are rats and storms; and to kill one of the rodent tribe and wish for fair weather, are, in his mind, rank heresies to trade.

The recent storm in the metropolitan district, when nearly 3 in. of rain fell in the course of twenty-four hours, is an event to be marked in red letters on this "brickey's" mind; and a letter sent him by a former working partner from Sydney, Australia, has caused the recipient great satisfaction:—"The parched earth has not been equal to carrying off the downpours of rain, and the finest floods have followed all over the country, sweeping away bridges, walls, slates, gables, drains, and paving. And you should have seen the hailstones walk into the glass! Some as big as hens' eggs. The lightning twisted chimney-stacks and pots in fine style, besides laying low numbers of buildings. Eh! old man, it was grand; and if you could have such a turn up in Pimlico once a year, you could snap your fingers at Cubitt. I am making a little fortune out of this storm." The Pimlico tradesman now regrets not going out with his chum to such an *El Dorado* for jobbing bricklayers as Sydney.

New Pier at Sandown.—A new pier was opened in Sandown Bay on the 29th ult. by Lady Oglander. The pier has been constructed by a local company, and is intended to be about 650 ft. long when completed.

GENERAL CONFERENCE OF ARCHITECTS, 1878.

THE following is the detailed programme of proceedings:—

Monday, June 3rd, 8 *p.m.*—Opening meeting. Presentation of the royal gold medal and of the Institute medals and prizes. Opening address by Mr. Charles Barry, F.S.A., president. Paper by E. Armitage, R.A., Hon. Associate; subject, "Mural Painting." The President and Council will receive gentlemen attending the Conference in the ground-floor galleries, between 7.30 and 8 o'clock.

Tuesday, June 4th, 11 *a.m.*—Visit to the New Law Courts (Strand entrance), where the drawings will be exhibited. Mr. G. E. Street, R.A., vice-president, will (if possible) be present to conduct the members. 2.30 p.m.: Visit to St. Paul's Cathedral (west entrance) to see the Wellington Memorial, and afterwards to examine the precautions taken to protect the dome from fire. Mr. F. C. Penrose, M.A., past vice-president, will conduct the members. 6.30 p.m.: The Institute dinner will take place at the Freemasons' Tavern. The president in the chair.

Wednesday, June 5th.—11 a.m. to 2 p.m.: Visit to Dorchester House, Park-lane, by the kind permission of R. S. Holford, esq. 2 to 5 p.m.: Visit to the Picture Gallery, Bridgewater House, by the kind permission of the Earl of Ellesmere. 8 p.m.: Meeting; paper by Professor Barff; subject, "The Corrosion of Iron." Chair to be taken by Professor Lewis, F.S.A., vice-president.

Thursday, June 6th.—11 a.m.: Visit to the New Natural History Museum (Central Entrance, Cromwell-road), South Kensington. Mr. A. Waterhouse, A.R.A., Member of Council, will meet the members to conduct them through the building. 3 p.m.: Meeting; Discussion on General Building Regulations for the United Kingdom. Paper to be read by Mr. J. Douglass Mathews, Fellow: subject, "The Model Bye-Laws as a Basis of a General Building Act." Chair to be taken by Mr. John Whichcord, F.S.A., vice-president. 8 p.m.: Meeting: discussion on Concrete and Fire-resisting Constructions. To be opened by Mr. Arthur Cates, Fellow. Chair to be taken by Mr. George Godwin, F.R.S., past vice-president.

Friday, June 7th.—11 a.m.: Visit to Mr. Kirkaldy's Testing Works, Southwark-street, when his apparatus for testing the resistance of materials used in construction will be explained and experiments made. 3 p.m.: Meeting; paper by Mr. Edward I'Anson, F.G.S., Member of Council; subject, "The Iron Ribs to Carry the Roofs of the Corn Exchange in process of re-erection in Mark-lane." Chair to be taken by Mr. E. M. Barry, R.A., Member of Council. 8 p.m.: Paper to be read before the Architectural Association at the rooms of the Institute, on "Rude Stone Monuments," by Mr. T. Roger Smith, Fellow; to be followed by a short paper on "Troy and Mycenæ," by Dr. J. S. Phené, F.S.A., Fellow.

Any day throughout the week.—11 a.m. to 2 p.m.: Visit to the Galleries of Grosvenor House, by the kind permission of the Duke of Westminster, K.G., Hon. Fellow.

LAMBETH PALACE.

THE Archbishop of Canterbury has given permission (transmitted through his librarian, S. W. Kershaw, M.A.) for all members of the Congress of Architects to visit the chapel and library on presenting their Conference card at the entrance gateway between ten a.m. and four p.m. on Monday, Wednesday, and Friday, the 3rd, 5th, and 7th of June.

The chapel is undergoing restoration, and new glass executed by Messrs. Clayton & Bell has been placed in the east windows. The vaulting has been partly decorated with Scripture subjects, and further work is contemplated.

The great hall (now library), rebuilt by Archbishop Juxon in 1663 is known to all, from its magnificent roof, after the type of Hampton Court and Eltham Palace.

Besides a choice collection of illuminated MSS., the following will have interest for the architect:—Albert Dürer's "Treatise on Perspective"; the "Elements of Architecture," by Wotton (with Evelyn's autograph); "Account of the Rebuilding of St. Paul's" (MS.); Plan of the Observatory at Greenwich (MS.); a rare book of engraved Portraits after Vandyke; with examples of ancient binding.

These will be specially exhibited under glass during the days fixed for the Conference visits.

LIBELLING A SURVEYOR.

GEORGE EDWARD BENSON was indicted at the Central Criminal Court, before the Recorder, for writing and publishing several false and defamatory libels concerning Sir H. Hunt, the consulting surveyor to the Office of Works, and Sir John Kelk.

In other counts the defendant was charged with sending the same libels to the Right Hon. Gerard Noel, First Commissioner of Works, in order to induce him to give him an appointment in the public service.

The prosecutor, Sir H. Hunt, it was stated, was a surveyor of eminence, and in 1856 he was appointed consulting surveyor to the Office of Works, with the understanding, however, that the appointment should not interfere with his private business, which he was permitted to carry on in conjunction with the appointment. Sir Henry was employed in his professional capacity in reference to the erection of the new Foreign Office in 1863, and at this time it appeared that the defendant was in the employ of Sir John Kelk as clerk. It appeared that tenders were originally sent in for the erection of the building upon a Gothic design suggested by Sir Gilbert Scott, but as Lord Palmerston objected to the Gothic style of building on account of its tendency to exclude air and light, the design of Sir Gilbert Scott was not carried out, but the firm of Sir John Kelk obtained the contract for laying in concrete for the foundations and erecting the building upon another design. The defendant seemed to have left his appointment with Sir John Kelk subsequently, and nothing was heard of him until the month of April last year, when he appeared in the first instance to have applied to Sir H. Hunt to obtain him a Government appointment, and threatened that if he did not do so he should "split" with reference to the transactions that had taken place between him and Sir John Kelk at the time the latter obtained the contract for the erection of the Foreign Office. Sir Henry Hunt did not take any notice of this letter, and the defendant then wrote to the First Commissioner of Works, in which he threatened to make certain revelations connected with what he described as the "Foreign Office job." No notice appeared to have been taken of the defendant's letter in the first instance, and the defendant wrote several others to the same purport, and eventually he made a communication to the effect that at the time of the contract being entered into by the Office of Works for the erection of the Foreign Office upon the new design, Sir H. Hunt had accepted a bribe of 500*l.* in the shape of a cheque from Sir John Kelk, for getting his tender accepted. The defendant appears to have persisted in this charge subsequently, and the present prosecution was preferred against him.

Formal evidence having been given in proof,

The Recorder, in summing up, told the jury that even if there had been any truth in the charges made by the defendant, the law would not allow him to make use of his knowledge of such transactions for the purpose either of extorting money or obtaining any lucrative employment, but in the present instance it appeared to him that it had been proved most conclusively that there was not the least foundation for the charges that had been made against Sir H. Hunt and Sir John Kelk, and that, in point of fact, these charges were absolutely false.

The jury, after a very short consideration, found the defendant guilty.

The Recorder, in passing sentence, told the prisoner he had been properly convicted of publishing a libel, and the only thing, as it appeared to him, that could be said in his favour was that the character of Sir H. Hunt and Sir John Kelk stood so high in the estimation of the public, that no one could believe the charges that were made against them, and they were not likely to have suffered any injury. It was, however, a most mischievous offence, and he should order him to be imprisoned and kept to hard labour for twelve months.

BUILDERS' RESPONSIBILITIES.

TAYLOR *v.* RICHARDS.

THIS was an action (in the Exchequer Division, before Baron Pollock) to recover damages for an accident caused by the negligence of the defendant. The plaintiff, who was a labouring man, aged 37, was in the employment of the defendant, Mr. Richards, a builder, of Vincent-square, Westminster.

In the month of March, 1877, Mr. Richards was employed in some building operations in Whitcomb-street, Leicester-square, and the defendant was engaged by him in that work. In the course of these operations it became necessary to pull down some walls, one of which was 40 ft. high, and it was alleged by the plaintiff that on the evening of the 20th of March, Mr. Richards himself gave him directions to pull down the wall the next morning, and pointed out a ladder about 22 ft. long, then leaning against the wall, as the one to use for the purpose. Accordingly, on the 21st the plaintiff commenced his work on the wall. For this he required a rope attached to a scaffold-pole at some height from the ground, and when mounting the ladder, which was placed against the wall, to get the rope, called to a companion beneath to bring him a "pick" to test the strength of the wall. His friend brought the pick and commenced climbing the ladder to hand it to him, when the ladder broke asunder about 7 ft. from the top. Dee, the second man, jumped off without hurting himself; but the plaintiff, who fell from a height of 15 ft., broke his ancle and was at once carried off in a cab to the Charing-cross Hospital, when it was found necessary to amputate his foot. He remained in the hospital for seven weeks, and while there received presents of money from time to time from Mr. Richards, which, however, were suspended on the plaintiff making a legal claim against him. For the defence it was contended that the plaintiff was only engaged to excavate, and had no business on the ladder at all, which the defendant had never directed him to use; that even if he had been employed on the wall, he had placed the ladder at a distance of 10 ft. from the base, and in such a position that it was almost certain to break. It was further stated that the ladder was in all respects a proper one for the purpose. It had been bought some six years before, and had since been painted and repaired when necessary.

After retiring for some minutes, the jury returned a verdict for the plaintiff for 20*l.*, and judgment was entered accordingly.

VENTILATION.

SIR,—Referring to the question discussed in the *Builder* of the 6th of April and 4th and 16th of May, as to whether the greater proportion of carbonic acid is found near the ceiling or near the floor of a room, it is probable that these proportions are very much influenced by the temperature.

Air which has been breathed, containing 5 per cent. of carbonic acid, would, at the temperature of the body, or 98 degrees Fahrenheit, be of the same specific gravity as pure air at about 83 degrees, and in a room containing pure air, at a temperature lower than 83 degrees, the breath, with the carbonic acid it contains, would rise towards the ceiling and collect there. As it cooled it would gradually descend and mix with the air of the room, and, if sufficient time were allowed and no draught existed, the greater proportion of carbonic acid would be found near the floor. Carbonic acid produced by artificial lights, being of a much higher temperature than breath, would rise more rapidly to the ceiling, and remain longer there. If the external atmosphere is of a lower temperature than 83 degrees, and the room is provided with openings at the top and bottom, the air would enter at the floor, and the breath would go out at the ceiling, the body of air in the room ascending.

On the contrary, in a room containing pure air at a temperature higher than 83 degrees, the breath would at once descend towards the floor, and if the room has openings, as before, and the external atmosphere has a temperature exceeding 83 degrees to any considerable extent, the air would enter at the ceiling and flow out at the floor.

Thus, at ordinary temperatures, while a room is occupied, and especially when artificial lights are used, the greater proportion of carbonic acid might be expected near the ceiling; but in very hot weather, or when a room is empty and has cooled down after having been occupied, the greater proportion would probably be near the floor.

If the temperatures were given at which the observations quoted by Mr. S. Snell were made, the differences in the results might be accounted for.

JOHN MACKENZIE, A.I.C.E.

CHURCH-BUILDING NEWS.

Bridlington Priory.—The late Sir G. G. Scott called public attention in September, 1875, to the condition of the old Minster at Bridlington, founded A.D. 1107. The interior of the church had been restored under his direction twenty years before, but the western front and other portions of the exterior remained for future treatment. Sir Gilbert prepared plans in 1875 for the reparation of the decaying parts of the church, and the rebuilding of the western towers. The work of restoration is now going forward. The north-west tower and north porch have been completed by the liberality of the Rev. Y. Lloyd-Graeme; the western front has been restored, and the south-west tower is in course of erection. Sir Gilbert stated in 1875 that the completion of the south-western tower alone would be a work which would richly repay the outlay incurred, and would render this noble structure beautiful as a whole, as it already is in its parts and details. Sir Gilbert took a special personal interest in the restoration of this church, which he often visited, and the beauty of which he greatly admired. He said, "The west window of the nave is a truly noble one,—no less than 55 ft. in height and 27 ft. in width,—while the two western portals with the rich panelling in which they are set, the noble double buttresses and the entire design of the tower, so far as it was erected, are of the highest class of the period, and bid fair to rival the corresponding parts at Beverley."

Henbury.—Henbury Church was recently reopened after restoration. The church is of the Early English period, and the long range of Norman columns, with Early Pointed arches, in the nave afford evidence of its antiquity; the register dates as far back as the year 1538. The work of restoration was placed in the hands of Mr. Street, R.A., and commenced in the autumn of 1875, and has been carried forward gradually, so as to interfere as little as possible with the conduct of divine service. As the work progressed it was found necessary to rebuild from the foundation the south wall and part of the east wall of the chancel; but this work was faithfully reproduced, and the Early English windows carefully replaced. The east window, which takes the place of a small seventeenth-century window, is entirely new, and it has been filled with stained glass by Mr. Daniel Bell, who is now preparing a window of the same character to replace the old lancet window at the south end of the Communion-table. The east window of the south chapel of the chancel has been filled with Munich glass, and the two south windows are by Messrs. Clayton & Bell. The new pulpit and reredos are the work of Mr. Earp, of Lambeth. The opening up of the tower and west entrance brings into view the long range of Norman columns. The contractors were Messrs. Wall & Hook, of Brimscombe, near Stroud, and the cost of the work, including the new windows, heating apparatus, &c., has amounted to 5,500*l.*

Middleham.—The parish church of St. Alkelda and St. Mary, Middleham, was re-opened on the 30th April, after restoration under the direction of Mr. Edward Low, architect. The restoration comprises a new organ-chamber and vestry, with cellar and heating chamber underneath, and new moulded and wrought oak roofs throughout, covered with cast lead. The walls of the chancel have been raised slightly, so that the principals of the roof should clear the apex of the chancel arch. The church throughout has been heightened by lowering the floors, in order that the bases of the pillars to the nave arcade should be exposed to view. Formerly the church was entered by descending three steps, but by lowering the path in the churchyard two steps only now are required, notwithstanding the excavation of the floor. The nave and aisles have been reseated throughout with open benches of pitch pine, varnished, placed on wooden floors. The chancel is fitted with canopied stalls, with seats for the choir. These stalls are made wholly out of the old oak from the ancient roofs. Mr. H. J. Osborn, of Darlington, was the contractor for all the woodwork. The aisles, choir, and chancel have been laid with tiles, plain and encaustic, by Messrs. Minton & Co. The whole of the stonework throughout has been repaired and cleansed from whitewash, &c., by Mr. Thorpe, mason, Middleham, who was the contractor for this portion of the work. All the windows throughout have been re-glazed with coloured quarry-glass, by Messrs. Croft & Sons, plumbers, Middleham, who also contracted for the gas-fittings, lead, and smith's work, the ornamental gas-fittings being supplied by Messrs. Richardson & Ellson. The font has been executed by Mawer, of Leeds. It is of Caen stone, with octagonal bowl, supported on Italian griotte marble shafts, on moulded bases. The pulpit is of wrought iron, executed by Mr. Winstanley. The oak reredos was executed by Robinson, of London, and has the panels filled in with some of the carved work found in the old seats. A two-light stained-glass window in the north aisle, and a three-light window in the chancel, have been executed by Messrs. Heaton, Butler, & Bayne.

DISSENTING CHURCH-BUILDING NEWS.

Ormskirk.—The new Wesleyan Methodist Chapel of St. Emmanuel, Ormskirk, was opened recently. It consists of a nave and side aisles and a tower, with entrance porch. The style is Early Decorated, the building being faced with Burnley shoddies, relieved with red stone dressings backed with brickwork, and the whole interior lined with plaster. There are three main entrances to the building, two fronting Derby-street, and one (the tower entrance) Railway-road. The chapel will at present accommodate 700 persons. Side galleries have been constructed, but seats will not be introduced therein until they are needed. The organ and choir gallery are immediately above the rostrum, and the former is so arranged as to allow of the choir facing the congregation. In the rear are placed the ministers' vestry and private entrance; two class-rooms, which can at any time be thrown into one; a large lecture-room, and the choir and stewards' entrance. The principals carrying the roof are massive hammer-beams of pitch-pine, filled in with cut work, and varnished. The benches and galleries are also executed in pitch-pine varnished, and the fronts of the galleries are filled in with richly-cut work. Mr. Peter Balmer, of Ormskirk, was the architect, and Mr. Thomas Riding the builder. The cost of the new church has been between 5,500*l.* and 6,000*l.*

Wellingborough.—A new "Independent Wesleyan" Chapel and schools were recently opened at Wellingborough. The building is of red brick, with Bath-stone dressings. The chapel and school are separate, but both under one roof. The former affords accommodation for some 300 persons. The school-room on the top floor provides seats for 200 children; and on the ground-floor about half that number of infants will be accommodated. Mr. E. Sharman was the architect, and Mr. Jabez Underwood, the contractor.

Newcastle-upon-Tyne.—On Good Friday a new chapel for the Methodist New Connexion was opened. The building is in the Venetian Gothic style of architecture, built throughout of stone, faced with thin pitched-faced blockers, and interspersed with bands of Penrith red stone. The interior is divided into nave and two side aisles, and ministers and leaders' vestries are provided. Ample provision is made for the congregation entering and leaving the building, there being six large and distinct exit doors, placed in convenient positions. The lofty nave roof is divided from the aisles by a light and elegant arcading, supported on ornamental cast-iron columns, which carry a clearstory wall. The galleries are placed in the two aisles and across each end of the nave, and are approached by wide staircases, communicating direct with the street. The woodwork throughout is stained and varnished; the seating being by means of open benches, with sloping seats and backs, accommodation being provided for about 900 persons, with a minimum width of 20 in. to each sitting. The acoustic properties were found to be highly satisfactory. The work has been carried out from the designs and under the superintendence of Mr. J. J. Lish, architect, Newcastle. The building has cost about 4,400*l.* The site for the chapel cost 600*l.*, and independently of the above works the congregation contemplate erecting a school to cost about 1,500*l.*, a minister's house to cost about 750*l.*, making a total of contemplated expenditure of 7,340*l.* Messrs. White & Sprout were the contractors for the work.

Books Received.

Kenning's Masonic Cyclopædia and Handbook of Masonic Archæology, History, and Biography. Edited by the Rev. A. F. A. WOODFORD, M.A. 198, Fleet-street. 1878.

THE institution of Freemasonry has never been more popular in this country than it is at the present moment, and the number of neophytes necessarily leads to a demand for books which afford a ready means to attain a general knowledge of its archæology and history. Fully recognising the existence of important works, such as those by Mackey, Schletter and Zille, and Kloss, Mr. Kenning saw that a smaller compendious Masonic cyclopædia of Masonry, as projected by the Rev. Mr. Woodford might yet find a class of readers in those who were unwilling or unable to obtain the larger and more costly books, and the result is the present publication. Mr. Woodford is a well-known and esteemed member of the craft, highly cultured, and with large stores of information, and he has made his book interesting not alone to Freemasons. Our own opinion has long been, with him, "that we have in speculative masonry the sequence of the guild system, which seems to have had a Roman origin in the 'Collegia Fabrorum,' and to have been grafted on to Greek, Egyptian, and Hebrew teaching. We cannot shut out from our consideration the enormous amount of confirmatory or indirect evidences, and the ceaseless witness of the Masons' Marks."

VARIORUM.

"OUR Debt and Duty to the Soil; or, the Poetry and Philosophy of Sewage Utilisation," by E. D. Girdlestone, though a very small book, gives a large amount of truth and knowledge in a pleasant manner.——"May & Co.'s Press Manual" (Gracechurch-street) gives a complete and correct list of all newspapers published in the United Kingdom, corrected to the end of 1877.——The new number of Cassell's "Household Guide" gives some instruction on grinding edge-tools:—"Edge-tools are fitted up by grinding, very much as a plank would be reduced in thickness were a large plane employed, in which were set a hundred or more very small

gouges, each cutting a narrow groove. The sharp grit of the grindstone being harder than the iron or steel, cuts very small channels in the surface of the metal, and the revolving disc carries away all the minute particles that are detached by the grit. If we were to examine the surface of a tool that had just been removed from a grindstone under the lenses of a powerful microscope, it would appear, as it were, like the rough surface of a field which has recently been scarified with some implement which formed alternate ridges and furrows. Hence, as these ridges and furrows run together from both sides, at the cutting edge, the newly-ground edge seems to be formed of a system of minute teeth, rather than to consist of a smooth edge. For this reason, a tool is first ground on a coarse stone, so as to wear the surface of the steel away rapidly; then it is polished on a wheel of much finer grit; and finally, in order to reduce the serrature as much as possible, a whetstone of the finest grit must be employed. This gives a cutting edge having the smallest possible serration. A razor, for example, does not have a perfect cutting edge, as one may perceive by viewing it through a microscope. Beginners are sometimes instructed, when grinding edge-tools, to have the stone revolve towards the cutting edge, and sometimes from it. When the first grinding is being done, it is a matter of indifference whether this is done or not; but when the finishing touches are applied near and at the very edge, a grinder can always complete his task with more accuracy if the periphery of the grindstone revolves towards the cutting edge, as the steel that is worn away will be removed more easily; whereas, when a stone runs in the opposite direction, the grinder cannot always tell exactly when the side of the tool is fully ground up to the edge. This is more especially true when the steel has a rather low or soft temper. The stone, when running from the edge, will not sweep away every particle of the metal that hangs as a 'feather'; but when the stone revolves towards the edge there will be no 'feather edge' to deceive the eye of the grinder."

——The following passage from Cassell's "Illustrated History of England" as to London morality prior to the Commonwealth, will serve to remind us that we have something to be thankful for:—"The riots of the apprentices had generally something of a John-Bullish assertion of right and justice in them; but the streets and alleys of London were infested with an equally boisterous, and much more villainous crew of thieves and cutpurses. Pocket-picking was then, as now, taught as a science, and was carried to a wonderful perfection of dexterity. All kinds of rogueries were practised on country people, the memory of which remains yet in rural districts, and is still believed applicable to the metropolis. These vagabonds had their retreats about the Savoy and the brick-kilns of Islington, but their great headquarters were in Whitefriars, called Alsatia, which possessed the right of sanctuary, and swarmed with debtors, thieves, bullies, and every species of miscreants, who were ready on an alarm, made by the sound of a horn, to turn out in mobs and defend their purlieus from constables and sheriff's officers. Walking the streets in the daytime was dangerous from the affrays often going on betwixt the apprentices and the students of the Temple, or between the butchers and weavers, or from the rude jostling and practical jokes of bullies and swash-bucklers; but at night there was no safety except under a strong guard. Then Alsatia, the Savoy, and the numerous other dens of vice and violence, poured forth their myrmidons, and after nine o'clock there was no safety for quiet passengers. If we add to this description the narrowness of the streets and alleys, the unpaved and filthy state of the streets, and undrained and ill-ventilated houses, London was anything at this period but an attractive place. The plague was a frequent visitant, and we are told that kites and ravens were much kept to devour the offal and filth of the streets instead of scavengers. In the country things were not much better. The roads were terrible, and were infested by sturdy bands of robbers. In the neighbourhood of London, Finchley, Blackheath, Wimbledon, and Shooter's Hill were places of well-known fame for daring highwaymen."——We printed, with commendations, a portion of Mr. Peregrine Birch's paper read at the Institution of Surveyors. Some of our readers may be glad to know that it is now published by Messrs. Spon, under the title "Sewage Irrigation by Farmers; or, Fifty Instances of Profitable Sewage Irrigation."

Miscellanea.

Waterloo Bridge Arbitration.—The *Land Agents' Record* publishes the proceedings in an arbitration case in which the Waterloo Bridge Company make a claim for 750,000*l.* against the Metropolitan Board of Works on the latter taking over the bridge under the Metropolis Toll Bridges Act, and which is the precursor of more arbitrations which will follow on the Board taking over other metropolitan bridges under the same statute. The arbitrators are Captain Douglas Galton, who acts as umpire, Mr. E. A. Miller, Q.C., and Mr. F. Meadows White, Q.C., and they sit at the Institution of Surveyors, Great George-street, Westminster. Among the witnesses have been Mr. H. Law, C.E., and Sir Joseph Bazalgette, engineer to the Metropolitan Board of Works. Mr. Law considered that the fourth, fifth, and sixth piers from the Middlesex side were in a critical state. Any day, in his opinion, an accident might happen. He did not say there was any danger to the public passing over the bridge, because any accident to the bridge would be accompanied by sufficient warning to protect the public. He considered that at any moment the bridge might fall, and that no prudent owners would allow it to remain in such a state. Sir Joseph Bazalgette advised that iron cylinders should be put round each pier. He would not like to take any responsibility with regard to the bridge unless some repairs of this kind were done to the bridge. The cylinders he would use were of the same kind as he had used in the construction of the embankment. The weakness of parts of the bridge was pointed out by us some time ago.

A Good Example.—Messrs. Cassell, Petter, & Galpin, with the view of benefiting those of their *employés* who have already given, or may hereafter give, long and faithful service to the firm in the various departments of their business, have resolved to set aside, from year to year, a fixed proportion of their profits, to form a Fund out of which certain benefits may, at their discretion, be paid. The scheme will provide for the payment of a sum of money, varying according to length of service, to the family or representative of any person who may die in their employment after seven, fourteen, or twenty-one years' service; or, as the case may be, for the payment of bonus of similar amounts to those who, having served at least seven years, may be incapacitated by old age, after the age of sixty-five, or who may before that age be totally unable to perform any labour, owing to accident or to incapacitating disease, such as blindness, paralysis, insanity, &c. It will further provide for paying, out of the sum so proposed to be set aside, an addition to the amount payable by the Belle Sauvage Sick Fund on the death of a member. But in no case will any *employé* be eligible for any of the benefits before mentioned should he leave the service of the firm, either of his own accord or by reason of dismissal from any cause.

New Baths for St. Pancras.—A view of the new Baths in Whitfield-street, publicly opened on the 8th of May, was given in our last volume (xxxv. pp. 1,222, 1,224). The site was originally purchased by the London School Board for the erection of a school, but in consequence of the outcry that they were about to introduce a school where it was not required, they resold the site to the St. Pancras Vestry for 5,500*l.*, and the building just erected and opened has cost altogether somewhere about 35,000*l.* The building is in the Moorish style. The two large swimming-baths occupy the north and south frontages; the latter is an exceedingly fine plunge-bath, 90 ft. by 28 ft., and graduated from about 4 ft. to 10 ft. or 12 ft. in depth; the second, or smaller swimming-bath, being 55 ft. by 24 ft. The interior of the large bath is decorated in the Moorish style of the building, its principal feature being a pendentive dome. The public wash-houses contain accommodation for seventy-eight women at one and the same time, and the drying-room and other apparatus are of commensurate proportions. Mr. Horace Gundry was the architect, and the work was carried out by Messrs. Kirk & Randall, of Woolwich.

Lighting the Foreign Office.—Messrs. J. Defries & Sons were very successful the other night in lighting the reception and conference rooms at the Foreign Office, on the occasion of Lady Salisbury's reception.

Wood Injection.—The value of creosote as a wood-preserver is generally recognised, but the direct injection requires great quantities of heavy oil, and a desiccation of the injected pores. The high boiling-point of creosote (300°) does not permit its employment in vapour. John Blythe formed the idea of saturating a jet of steam with creosote in minute division, forming, so to speak, a gaseous emulsion. The apparatus comprises a high-pressure steam-boiler; another boiler containing creosote, in which the steam is saturated; a vat, filled with creosote, to be pumped into the boiler; sheet-iron cylinders, for the pieces which are to be injected; and a system of tubing connecting the several parts. In this way Mr. Blythe completely fills the heart of oak, pine, or red beech; he uses 2 to 3 kilos. of creosote for a cross-tie, and 2 kilos. of brown phenic acid per cubic mètre of saturated wood or cross-ties. The cost of preparing a cross-tie, measuring 0·085 m., is from 0·60 f. to 0·70 f. The apparatus can prepare 500 ties per day; the wood comes out softened, so that it can readily be bent or shaped, but it rapidly hardens; at first it shrinks, but after a few weeks it becomes seasoned and resists the influences of moisture; finally, the fibres are greatly strengthened. — *Ann. des Ponts et Chaussées.*

The Shaftesbury Park Estate.—On Saturday evening a meeting of the tenants on this estate was held on the estate, to call public attention to an alleged breach of faith on the part of the company, which was founded for the ostensible purpose of giving to the working classes "healthy homes at low rents." Mr. Pace, a tenant, took the chair. Attention was drawn to the original prospectus of the company, setting forth that the company would give improved dwellings at the lowest cost in rent or purchase—the tenants to have the opportunity of purchasing their dwellings at a fair cost upon the outlay. The dwellings were to be in four classes, the highest 26*l.* a year, the others being 8s., 6s. 9d., and 5s. 9d. a week. The large defalcations which formed the subject of criminal trials and convictions occurred, and the complaints of the tenants on Saturday were that the company had twice raised the rents of the three lower classes of houses, and intended to make them still higher. The 8s. a week houses had already been raised to 10s., the 6s. 9d. to 8s. 6d., and the 5s. 9d. to 7s. 6d. The meeting resolved to appoint a committee to wait upon the directors, and one speaker said that if the tenants could not get satisfaction they would engage to "clear off" the estate.

Crystal Palace.—A large and appreciative audience assembled last Wednesday at the Crystal Palace on the occasion of the second operatic concert there, when Madame Adelina Patti, with other members of Mr. Gye's Company, appeared, it is scarcely necessary to say with the most gratifying results. Madame Patti was twice encored, once in a duet with Mdlle. Scalci. Madlle. Zarè Thalberg was announced to sing, but did not put in an appearance; inasmuch, however, as Mdlle. Smeroschi, who is apparently capable of supplying the place of any absentee whether in opera or concert, was present, the programme was not altered.

The "Stanley" Sash-fastener and Window-opener.—Under this title Mr. Edwardes, an architect, has patented an arrangement for opening and closing large and lofty plate-glass windows with ease, and which at the same time includes a sash-fastener. There is a considerable strain upon the cords employed, but even should one of them yield after a certain amount of wear, it can be replaced with very little trouble. In many houses there are top sashes which are never pulled down, because of the difficulty attending the operation. This can be obviated by the use of the "Stanley," and the cost is very small.

Time and Prime-Cost Books.—Mr. W. S. Oxborrow, of Stowmarket, has prepared and published some new prime-cost books, distinguished for simplicity, and adapted for carpenters, builders, and contractors. For example, Time Book, No. 1 is arranged to prevent workmen overdrawing contracts, and to detect errors on balancing. It has fourteen general headings which are subdivided to meet all requirements. The Labour Cost Book is provided with columns for distinctly showing workmen's number, amounts paid for each class of labour, charges for horses and machinery employed, entire outlay on job, also trading expenses and the charging prices to customers.

The Incrustation of Boilers.—A writer in *Chambers's Journal* says:—Put a lump of zinc into the boiler of a steam-engine, and it will prevent the formation of "scale"; that is, the stony crust, which, as all engineers know to their sorrow, is very injurious, and involves constant expenditure. The experiment having been successfully tried during four years by certain manufacturers in France, the minister of public works appointed a commission to inquire into and report upon it. From their report, which was published last year in the "Annales des Mines," we learn that the zinc is to be placed in the boiler as far as possible from the furnace, the quantity being a quarter-pound for every five square feet of boiler-surface, if the water be soft, and half-pound if the water be hard. The boiler is then worked in the usual way; and when opened for the usual cleaning the appearances, as the Commission describe, will be:—If the water be but slightly calcareous, the deposits, instead of forming solid and adherent scale, are found in a state of fluid mud, which is easily removable by simple washing. The iron being clean and free from rust, no picking or scraping is needed, whereby an important saving of time and labour is effected. On the other hand, if the water be strongly calcareous or hard, the deposits are as coherent and strong as though the zinc had not been employed; but this strong coat does not stick to the iron. It can be pulled off by hand, or at the worst detached without much effort, leaving the iron clean. A simple washing clears it from the boiler; and in this case, as in the foregoing, picking and scraping are avoided.

Fetteresso.—The Established Church at Fetteresso, N.B., has been re-opened, after restoration. The church was built in 1810, and was seated for 1,400 persons. Since then the parish of Fetteresso has found it necessary at different times to erect two *quoad sacra* churches to meet the requirements of the inhabitants, one church being at Cookney and one at Rickarton. The church was extremely plain in appearance, both outside and inside, till about two years ago, when Mr. Baird, of Urie, introduced a large organ, also erecting an addition at the north end, the gallery being occupied by the organ, and the lower part as a vestry. The old pulpit was removed, and a new one erected, and the old seats in front and on the sides were removed, and new ones substituted. These alterations were done by Mr. Baird, at a cost of about 2,000*l.*, entirely by himself. After these alterations had been completed it was seen that the old part presented a most unfavourable appearance, and the congregation at once set to work to have the whole renovated. This has now been done by the contractors, Messrs. Fettes & Stephen, Montrose, under the superintendence of James Garvie & Sons, Aberdeen, at a cost of about 1,000*l.*

King of the Belgians' Prize.—Our readers may remember that the King of the Belgians, writing through the Society of Arts, has given notice that at the next International Congress he will offer a prize "to the municipal authority, or private association, which shall, by the improvement of the dwellings of the wage classes, effect the greatest reduction of their death rates at the lowest cost." The communication has been well considered by the Improvement Committee of the Corporation, of which Mr. J. T. Bedford is chairman, and they are unanimously of opinion that with the view of competing for his Majesty's prize all necessary particulars relative to Corporation buildings and Viaduct buildings should be furnished to the Society of Arts. It appears that the buildings in question accommodate more than 1,000 persons, and that while they "pay" at least four per cent. interest net upon the total outlay, the death-rate which has in this very neighbourhood averaged something like 60 per 1,000 is now reduced to 20,—a change which is of the most highly satisfactory and gratifying character.

The Metropolis Management and Building Acts Amendment Bill, which makes provision for the construction of music-halls and theatres, &c., was, on the motion of Lord Middleton, read a second time in the House of Lords on Tuesday, and referred to a Select Committee.

Social Science Congress.—The Council has accepted an invitation from Cheltenham to hold their next annual Congress in that town. The meeting is fixed to take place from the 23rd to the 30th of October.

Liverpool Engineering Society.—This society held its usual fortnightly meeting on Wednesday, the 22nd ult.,—Mr. Robinson Souttar, president, in the chair. Mr. Alexander Ross, C.E., read a paper on "The Permanent Way of Railways." The author gave an historical sketch of the different permanent ways in use, and which have been proposed, describing the stone-block system laid on the Stockton and Darlington and Liverpool and Manchester Railways. This road was laid so rigid as to be most uncomfortable to travel over and injurious to rolling stock, and it was consequently superseded by timber sleepers. The permanent way of the present day is in its essential features the same as that used on the earlier railways. The different parts have, however, been constantly increasing in size and weight to keep pace with the growth of traffic and with the necessarily increased weight of engines.

The Church and the Stage.—Thanks to the active zeal of Mr. William Gowing and Miss Evelyn (Mrs. Gowing), an entertainment was organised for Monday afternoon last, at St. George's Hall, in aid of the Vicarage Fund of St. Michael and All Saints, North Kensington, and went off well. Miss Evelyn and Mr. Howe gave two scenes from the "Love Chase" with great spirit, and later in the afternoon a poem of Miss Evelyn's was recited by Miss Emily Faithfull. Mr. Irving read a scene from Hamlet," Mr. G. Grossmith, jun., sang an interesting lyrical scene, Miss Ada Cavendish recited "The Spanish Mother," and Mr. Toole gave his sketch, "Trying a Magistrate." The sum of 175*l.* was added to the fund.

The Corporation of Blackpool has received the sanction of the Local Government Board to borrow money for the following works:—Groynes on the foreshore, 5,000*l.*; paving Parade, 5,784*l.*; land, buildings, and railway siding for a new town's depôt, 3,524*l.*; buildings at existing town's depôt, 900*l.*; extension of gasworks, 10,200*l.*; land for a street improvement, 1,067*l.*; total, 26,475*l.*

TENDERS

For alterations at the Adam and Eve, Nos. 284 and 286, Euston-road, for Mr. T. Potter. Mr. J. R. Furniss, architect. Quantities supplied:—

Toms	£869 0 0
Drew	856 0 0
Handley	827 0 0
White	812 0 0
Marks	810 0 0
Baugh	775 0 0
Bishop	720 0 0

For alterations and repairs at No. 41, Castle-street East, W., for Mr. Boyd. Mr. A. E. Hughes, architect:—

Bywater, Brothers	£440 0 0
Burningham & Co.	425 0 0
Simpson & Son	420 0 0
Perkins	369 0 0
Baugh (accepted)	320 0 0

For twelve cottages, at Waterloo, Radstock, for Mr. F. Parsons. Messrs. Wilson, Willcox, & Wilson, architects:—

Bird (accepted)	£1,050 0 0

For twelve cottages, at Waterloo, Radstock, for Mr. T. H. Worger. Messrs. Wilson, Willcox, & Wilson, architects:—

Bird (accepted)	£1,050 0 0

For residence and shop, at Radstock, for Mr. F. Parsons. Messrs. Wilson, Willcox, & Wilson, architects:—

Bird (accepted)	£811 0 0

For the erection of a Baptist chapel, with vestries, schoolroom, boiler-room, &c. attached, at Curtisden-green, Goudhurst, Kent. Mr. W. Theobalds, architect:—

Tully (accepted).

For the erection of a house, in Albert-place, Lambeth-road, for Mr. T. Packer. Mr. W. Theobalds, architect:—

Cade & Thompson (accepted)	420 0 0

For Sewage works, Holmesdale-road, Croydon, for the Croydon Local Board of Health:—

Dover, Brothers, & Co. (accepted)	£539 9 0

For the erection of four labourers' cottages, at St. Paul's Cray, Kent. Mr. W. Ranger, architect:—

Ennor, Julian, & Co.	£902 0 0
Taylor & Son	798 0 0
Richardson, Brothers	774 0 0
Laslett	729 0 0
Booker	710 0 0
Haisman	686 11 0

For alterations and additions to stable and coach-house, No. 4, Hall-road, St. John's Wood, for Mr. Bowles. Mr. G. Fleetwood, architect:—

Gould & Brand	£329 0 0
Lovell	280 0 0
Phillips & Son	278 0 0
Scrivener & Co.	267 0 0

For alterations at the Monarch Tavern, Chalk Farm-road:—

Toms	£796 0 0
Jackson & Todd	750 0 0
French	698 0 0
Kingsman	659 0 0
Lamble	595 0 0

For farm-house and buildings, at Heathfield Farm, Hounslow, for Mr. T. C. Cowper. Messrs. Walter Graves & Hubert, architects. Quantities supplied:—

Vears & Co.	£1,195 0 0 !
Hooke & Oldrey	850 0 0
Hiscock	799 0 0
Haynes	685 0 0 !

For alterations to premises, at Bermondsey, for Mr. J. Feaver. Mr. J. Gale, architect:—

Hoare & Son (accepted)	£358 0 0

For the erection of an infant school, at Landscore, Crediton. Mr. Charles Pinn, architect. Quantities not supplied:—

Marshall	£850 0 0
Brooks	849 15 0
James	779 15 6
Berry	770 0 0
Pillar	756 13 6
Ditto, amended	736 13 6
Dart	724 0 0

For the erection of a cottage on the Horton Estate, at Epsom, Surrey, for Mr. Charles Tisdall. Mr. J. Hatchard Smith, architect:—

Hopkins (accepted)	£235 0 0

For the erection of a cottage residence, at Epsom Common, for Mr. Edwards. Mr. J. Hatchard Smith, architect:—

Jeal (accepted)	£230 0 0

For the erection of six houses and shops at Holloway. Messrs. H. S. & C. A. Legg, architects:—

J. & H. Cocks	£6,780 0 0
Palmer	5,875 0 0
Prout	5,345 0 0
Eady	5,275 0 0
Steed, Brothers (accepted)	4,460 0 0

For the restoration of Spilsby Church, Lincolnshire. Mr. W. Smith, architect. Quantities not supplied:—

Thompson	£4,518 0 0
White & Wood	4,493 0 0
Hunter & Son	4,410 0 0
Wade	4,066 0 0
Walter & Hensman	3,943 0 0
Lilley	3,790 0 0
Young	3,780 0 0
Storey (accepted)	3,243 0 0

For additions to a detached residence, Pine Ridge, Farnham, Surrey, for Mr. George Goodall. Mr. G. Edwards, architect:—

Kemp	£1,150 0 0
Richardson	1,085 0 0
Hughes	979 0 0
Martin, Wells, & Co. (accepted)	880 10 0

For farmhouse and buildings on Chapel Farm, near Thetford, Norfolk, for Captain Frederick Wentworth Bennett. Messrs. Powell & Swettenham, architects. Quantities supplied:—

	Building in Concrete.	House in Concrete.	House in Brick.
Woodhouse	£2,075	£1,210	£1,193
Bardell, Brothers	2,021	1,066	1,121
Hubbard	2,017	1,169	1,532
Bell & Sons	1,978	1,246	1,168

For alterations and additions to 163, Commercial-road, Newport, Monmouthshire, for Mr. G. J. Kenvyn. Mr. H. A. Goodman, architect:—

Sherram	£231 10 0
Whittaker	175 0 0
Moulton & Brownscombe (accept.)	170 0 0

For Parsonage House at Rowfant, Sussex, for Lady Lampson. Mr. E. P. Loftus Brock, architect:—

Carter & Son	£2,097 0 0
Brass	1,886 5 2
Jarrett	1,850 0 0
Mattock, Brothers	1,649 0 0
Ditto (if stone faced)	1,722 0 0
Shearburn	1,566 0 0
Ditto (if stone faced)	1,766 0 0

For new lodge at Girls' Home, Sudbury Hall, for Mr. W. Williams and the Committee. Mr. E. P. Loftus Brock, architect:—

Brass	£448 0 0
Ennor, Julian, & Co.	440 0 0
Bowman	427 0 0
Kindell	405 0 0
Mattock	397 0 0
Haynes	345 0 0

For five villa residences at Aylesbury, for Mr. Mead. Mr. James Holland, architect:—

Groome	£2,841 0 0
Berry	2,700 0 0
Jones	2,695 0 0
Woodbridge	2,636 0 0
Benson & Pidduck	2,610 9 7
Coles	2,578 0 0
Cooper	2,495 0 0
Taylor & Co.	2,445 0 0

For houses for Mr. Banner, Donnington-road, Reading. Mr. Joseph Greenaway, architect:—

Groome (accepted)	£2,017 14 0

For the East Bury vicarage, Hants, for the Queen Anne's Bounty. Messrs. J. & E. Baddeley, architects:—

Groome (accepted).

For wainscot, oak, and mahogany fittings in Messrs. S. Smith & Co.'s new bank, Nottingham. Mr. George R. Isborn, architect. Quantities supplied:—

Dennett & Co. (accepted)	£944 4 0

For works at Limehouse. Mr. T. J. Hill, architect:—

M'Cormick	£1,050 0 0
Anley	867 0 0
Hewitt	815 0 0
Lewis	750 0 0

For three houses at Hampstead, for Mr. John Inman. Messrs. Satchell & Edwards, architects:—

Jones	£4,386 6 10
Hockly	4,332 0 0
Smerdon (too late)	4,305 0 0
Sanders (accepted)	4,269 0 0

For lodge for the Sanitary Dwellings Company (Limited), John-street, N. Mr. Banister Fletcher, architect :—

Angood	£750	0	0
Tyerman	750	0	0
Hobern	690	0	0
Bayes, Bros., & Allen (accepted)	670	0	0

For new rooms, Pentonville, for Messrs. Brewis, Brothers. Mr. Banister Fletcher, architect :—

Tyerman	£597	0	0
Bayes, Brothers, & Allen	585	0	0
Hobern (accepted)	545	0	0

For extension of stabling, Pentonville, for Messrs. Brewis, Brothers. Mr. Banister Fletcher, architect :—

Bayes, Brothers, & Allen	£256	0	0
Hobern (accepted)	249	0	0

For proposed warehouse at 45, City-road, for Mr. W. H. Prestwich. Messrs. Ashby & Green, architects :—

Rowe	£2,022	0	0
Stamp & Bowtle	1,971	0	0
Staines & Son	1,568	0	0
Pocock	1,485	0	0
Jackson & Todd (accepted)	1,445	0	0

Accepted for Wesleyan Sunday Schools and Lecture-hall, Queen-street, Scarborough. Mr. William Watson, architect :—

Excavating, Brickwork, Stonework, Slating, and Plastering.

Bastiman	£1,043	0	0

Carpenter's and Joiner's Work.

Fletcher	£595	0	0

Plumbing, Glazing, Ironwork, and Gasfitting.

Whittaker, Brothers	£85	3	0

Painting.

Thompson	£34	5	0

For repairs to the St. John's vicarage, Wakefield. Mr. William Watson, architect :—

Fawcett	£405	6	9
Guest & Craven	405	0	0
Furness	385	8	3
Flower	304	0	0
Fawcett	297	15	9
J. & J. Mountain (accepted)	290	0	0
Bagnall, Brothers	258	7	0

For alterations to No. 45, George-street, Portman-square. Mr. John Robinson, architect. Quantities supplied :—

Curtis & Sons	£1,176	0	0
Longmire & Burge	949	0	0
Lathey, Brothers	937	0	0

For rebuilding the Royal Oak, Tavern, Leatherhead, Surrey, and building two pairs of cottages, for Mr. James Atlee. Mr. Charles Bowes, architect. Quantities by the architect :—

Walker	£1,985	0	0
Parsons	1,928	0	0
Lathey, Brothers	1,750	0	0
Jones	1,730	0	0
Norris	1,678	0	0

For alterations to the Marlborough Head, Pelham-street, Spitalfields, for Mr. F. Garner. Mr. Edward Brown, architect :—

Mann	£462	0	0
Kiddle & Son	375	0	0
Christoffer	358	0	0

For rebuilding No. 252, High-street, Poplar, for Mr Henry Wickes. Messrs. A. & C. Harston, architects :—

Jacobs	£1,760	0	0
Palmer	1,650	0	0
Riddall	1,600	0	0
Sheffield & Prebble	1,597	0	0
Coleman	1,573	0	0
Hearle & Son	1,493	0	0
Johnson (accepted)	1,397	0	0

For altering and fitting up No. 26, Canal-walk, Southampton, for the Refreshment Rooms Company. Mr. W. H. Mitchell, architect :—

Stevens & Son	£124	0	0
Brinton & Bone	120	0	0
Rowland (accepted)	119	0	0

For the erection of a Church of England School, Shirley Warren, near Southampton, for Mr. Andrew Barlow. Mr. W. H. Mitchell, architect :—

Holt	£568	0	0
Crook	559	0	0
Richards	491	0	0
Rowland (accepted)	470	4	0

For taking out old lead water-pipes and substituting block tin and lead encased piping at South Stoneham Union Workhouse. Mr. W. H. Mitchell, architect :—

Brinton & Bone	£325	0	0
Wright & Co.	302	17	6
Penny	297	13	4
Haines	273	3	0
Brazier	258	0	6
Comport (accepted)	241	0	0

For converting old boiler-house into provision store at South Stoneham Union Workhouse. Mr. W. H. Mitchell, architect :—

Haines	£75	2	0
Rowland (accepted)	75	0	0

For sewers at Clapham, Balham, &c., for the Metropolitan Board of Works. Quantities by Mr. Charles W. Whitaker :—

Reddin	£42,079	0	0 !
Dickinson & Co.	29,900	0	0
Mowlem & Co.	25,000	0	0
Killingbeck	24,400	0	0
Stevens	24,000	0	0
Nowell & Robson	23,897	0	0
Dunmore	23,235	0	0
Hook & Oldrey	23,000	0	0
Young & Co.	22,000	0	0
Crockett	21,400	0	0
Cooke & Co.	21,000	0	0
Webster	20,300	0	0
Ford & Norris	20,050	0	0
Downs & Co.	18,460	0	0
Williams & Co.	17,800	0	0
Pearson	16,800	0	0 !

For the erection of a warehouse, situated at 40 and 41, Bartholomew-close, for Mr. J. Hull. Mr. Kirkby, architect :—

Ramsey	£2,298	0	0
Greenwood	2,267	0	0
Lawrence	2,209	0	0
Patman & Fotheringham	2,155	0	0
Axford	2,145	0	0
Weeks & Son	2,094	0	0

For printing-house, Broad-street, Bristol. Mr. H. Masters, architect :—

		Deduct.
Boon	£2,824	£123
Shipp	2,499	90
Veals	2,474	120
Banner & Co.	2,460	115
Wilkins & Hill	2,448	99
Davis	2,440	130
Beavan	2,376	108
Stephens & Bastow	2,375	130
J. & S. R. Garratt	2,363	105
Easterbrook & Sons	2,340	110
Beaven & Sons	2,330	115
Pugsley	2,300	122
Howell & Sons	2,030	105
Hatherly	1,935	95

House, Sutton.—Quantities were supplied by Mr. Tutt, not "Ivett," as printed.

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Ventilation (some communications on this subject will have consideration next week).

All statements of facts, lists of tenders, &c. must be accompanied by the name and address of the sender, not necessarily for publication.

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